DOCUMENT RESUME

ED 183 378 SE 030 110

AUTHOR	Driscoll, Mark J.
TITLE	Elementary School Mathematics Annotated Bibliography.
INSTITUTION	Central Midwestern Regional Educational Lab., Inc., St. Louis, Mo. R&D Interpretation Service.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.
PUB DATE	Sep 79
NOTE	127p.
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	*Annotated Bibliographies: Attitudes: Calculation: Cognitive Development: Concept Formation: Content Reading: Creativity: Educational Diagnosis: Elementary Education: *Elementary School Mathematics: Manipulative Materials: Mathematics Curriculum: Mathematics Instruction: Problem Solving: Research: *Research Reviews (Publications): Sex Differences: Socioeconomic Influences
IDENTIFIERS	*Calculators

ABSTRACT

This annotated bibliography lists research synthesis in elementary school mathematics. The listings are in alphabetical order, but are also indexed according to topics. Among the 17 topics included are: calculators, problem solving, sex differences, and diagnosis and remediation. (MK)

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Elementary School Mathematics Annotated Bibliography

Mark J. Driscoll
Research Associate
R&D Interpretation Service

CEMREL, Inc.
cemrel

SE 030 110

Foreword

For the past two years the staff members of the Research and Development Interpretation Service (RDIS) have been collecting research syntheses in elementary school mathematics. This annotated bibliography is a result of that process and of our work to select out the items that will be of most use to the regional exchanges and their clients.

The bibliography is organized in alphabetical order, but the items are also indexed according to topic area. Since our collecting process is a continuing one and since we shall be sending you additional pages as we expand the bibliography, we recommend that you keep your copies in a looseleaf binder.

If there are listed documents which you would like to borrow from our collection, please contact the RDIS staff.

Mark J. Driscoll
Research Associate for Mathematics
Research and Development Interpretation Service
September 1979

CEMREL, Inc.
3120 59th Street
St. Louis, MO 63139
314/781-2900

Author:
Aiken, L.R., Jr.

Accession Number:
M A 0 2 3

Title:
Ability and creativity in mathematics, Columbus, Ohio: Eric Information Analysis Center for Science, Mathematics, and Environment Education, 1973. (ERIC Document Reproduction Service No. ED 077 730)

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University - College of Education
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: $1.60 (offset with cover)

Order No.: 217M

Abstract:
The relationships of intelligence, achievement, age, sex, heredity, and psychosocial factors to mathematical creativity are reviewed and discussed in this document. A bibliography of 125 references, the most recent of which is dated 1972 is included.

From the diverse results reported when measures of creativity are related to measures of intelligence, the author concludes that the correlations between measures of mathematical creativity and achievement in mathematics are higher than those found between measures of general creativity and mathematical achievement. Some research dealing with the influence of heredity on mathematical abilities found that nervous systems of some people may be more sensitive to stimuli having mathematical characteristics (relations, symbols, numbers); hence, these people can form associations involving mathematics with less effort and retain them longer; such people are also more resistant to fatigue associated with mathematical activity. Regarding sex differences, research results show that, on the average, girls tend to score higher than boys on tests of verbal ability, arithmetic fundamentals and rote memory; whereas, boys are superior in spatial ability, arithmetic reasoning and problem solving with all differences less pronounced in the early grades.

In discussing implications for teaching creative students, the author suggests stressing independent rather than group activity and emphasizing exploration and discovery of concepts rather than relying on didactic presentations.

Author:
Aiken, L.R., Jr.

Accession Number:
MA064

Title:
Affective variables and sex differences in mathematical abilities. Paper presented at the annual meeting of the American Educational Research Association, Chicago, 1974. (ERIC Reproduction Service No. ED 089 997)

Availability:
ERIC Document Reproduction Service
P.O. Box 190
Arlington, Virginia 22210

Cost: HC $1.67
MF $0.83

Order No.: ED 089997

Abstract:

This article discusses the literature on sex differences in mathematics achievement and advances four possible explanations to account for the differences. The list of references includes 17 sources, including one dissertation and one personal communication. The most recent citation is dated 1973.

The four proposed explanations to account for sex differences in mathematics are: masculine identification, differential social reinforcement, same sex-role modeling, and sex-linked recessive genes. Research suggests that "improving their attitudes toward mathematics seems to help girls do better in the subject and casting mathematical problems in terms of "typical feminine interest content improves girls'scores on those problems."

Author:
Aiken, L.R., Jr.

Accession Number:
M A 0 2 5

Title:
Language factors in learning mathematics. Columbus, Ohio: ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, 1972. (ERIC Document Reproduction Service No. ED 068 340)

Availability:
ERIC/SMEAC - Information Reference Center
Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $1.35 (offset, with cover)

Order No. 211M

Abstract:

This paper focuses on the relationship of verbal factors to mathematics achievement and reviews research from 1930 to 1971. A total of 96 books, journal articles, and dissertations are cited. The research deals primarily with middle and upper elementary school grades. Major findings include:
1) various measures of general and specific reading abilities show positive correlations with scores on arithmetic and mathematics tests;
2) scores on tests of mathematical and verbal abilities are also correlated with general intelligence; and
3) instruction in reading in general or the reading of mathematics in particular improves performance in mathematics.

The author offers the following suggestions for further research:
1) multivariate studies of the relationships among selected aspects of mathematics and various linguistic variables;
2) separate correlational analyses for different age and sex groups;
3) studies of the relationship between mathematical development and language development;
4) experiments concerned with the effects of instruction in vocabulary and reading on mathematics learning;
5) comprehensive surveys of the vocabulary levels and readabilities of mathematics textbooks;
6) experiments to test specialized methods of teaching verbal-problem solving;
7) studies with large groups of children at different age levels to determine the effects of both covert and overt verbalizations by the students, as well as nonverbal behavior, on solving mathematics problems; and
8) development of some scheme for analyzing mathematical language per se.

Author:
Aiken, L.R., Jr.

Accession Number:
M A 0 3 3

Title:
Research on attitudes toward mathematics. The Arithmetic Teacher, 19:229-234, 1972.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA. 22091

Cost: $2.50

Abstract:

A summary and extension of a 1970 review of research on attitudes toward mathematics. Discussed are how to measure attitudes toward mathematics; how attitudes are related to achievement in mathematics; how attitudes are related to personality differences; how attitudes held by children are related to attitudes of their parents and teachers; and how attitudes toward mathematics may be improved. Seventeen studies done between 1962-1970 are reviewed.

Research findings indicate that Thurstone, Likert, and semantic differential techniques can be used to assess attitudes toward mathematics. A 20-item Likert scale is given as an example. Other results indicate that the relationship between attitudes and achievement tends to be lower in early elementary grades; that attitudes and achievement are mutually interactive; that attitudes toward mathematics have positive correlations with verbal and quantitative ability and a masculine interest pattern; that attitudes of both boys and girls tend to be more closely related to the attitudes of their mothers than to those of their fathers; and that relationships exist between student attitudes and those held by their teachers.

To improve attitudes toward mathematics, the author recommends that teachers try to associate mathematics with things the learner views as pleasant, interesting, or of potential value.

Author:

Aiken, L.R., Jr.

Accession Number:

M A 0 0 9

Title:

Update on attitudes and other affective variables in learning mathematics. Review of Educational Research, 46:293-311, 1976.

Availability:

American Educational Research Assn.
1126 16th St., N.W.
Washington, D.C. 20036
(quarterly publication)

Abstract:

Presented is a review of research concerned with attitudes toward mathematics reported since 1969. Reference list of 108 citations include 69 dissertations completed between 1969-1974. Topics reviewed are techniques for measuring attitudes toward mathematics; the relationships between attitudes and achievement in mathematics; sex differences in attitudes toward mathematics; the affects of teacher attitudes toward math on students being taught; and the affects of curriculum structure and behavior modification on attitudes and anxiety toward mathematics.

Research findings indicate that when attitude scores are used as predictors of achievement in mathematics, a low but significant positive correlation is usually found; late elementary grades are viewed as particularly important times for the development of attitudes toward math; differences in attitudes and achievement in mathematics are frequently found to favor boys over girls by the time students are in junior high; positive attitudes toward mathematics are related to a number of personality variables indicating good adjustments; studies dealing with the relationship between teacher attitudes and either attitudes or changes in attitudes of students show mixed results; research on the effects of innovative versus traditional courses in mathematics on attitudes toward mathematics are inconclusive; behavior modification procedures used to improve attitudes toward mathematics report positive changes.

The author finds that methods used to measure attitudes toward mathematics have improved in quality. Use of multivariate designs and multidimensional measures are recommended for further research.

Author:
Aiken, L.R., Jr.

Accession Number:
M A 0 3 7

Title:
Verbal factors and mathematics learning: A review of research. Journal for Research in Mathematics Education 2:304-313, 1971.

Availability:
NCTM
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Abstract:

This paper discusses the relationships between:
1) mathematical ability, reading ability and general intelligence;
2) reading instruction and mathematics learning (including methods of teaching word problems; and
3) student and teacher verbalization (interaction and verbalization of mathematical principles). Twenty-six studies, published mainly between 1952 and 1970, are referenced.

Results of research indicate that:
1) reading achievement is positively related to scores on tests of mathematics achievement throughout the range of school grades ($r = .45$ to $.55$);
2) correlations found between reading achievement and mathematics achievement are not due entirely to differences in general intelligence;
3) mild research support exists for maintaining that training in reading in general or training in reading mathematics in particular improves achievement in mathematics;
4) the ability of secondary students to verbalize a mathematical principle does not guarantee better performance on problem-solving tasks; and
5) teachers who use "direct verbal behavior" or "rejected student talk" (Flanders System of Interaction Analysis) increase the computational achievement of students who are average in intelligence.

The author proposes long-term multivariate investigations be done to assess the influence of variables such as general ability, personality variables, teacher background and style, classroom structure , and structure of the curriculum on mathematics achievement.

Author: American Institute for Research

Accession Number:

M A 0 5 5

Title:

Metric Education. Interpretive Report No. 1. Washington, D.C.: Institute for Educational Leadership. George Washington University, 1975. (ERIC Document Reproduction Service No. ED 118431)

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: HC $1.67
MF $0.83

Order No. ED 118431

Abstract:

This report reviews the findings of two projects funded by the National Institute of Education (NIE) and conducted by the American Institute for Research (AIR). The project reports, "Going Metric" and "Metric Inservice Teacher Training," document the impact of metric conversion on the educational systems of Great Britain, New Zealand, Australia, South Africa, and Canada in order to provide educators and other planners with guides for preparing a national conversion program. Three vital needs were identified for a successful conversion policy in the U.S.:

1) a broadscale involvement of all major elements in early planning;
2) a committed government policy and firm schedules; and
3) continued communication and coordination as conversion progresses.

Recommendations include:

1) the creation of a national evaluative body that would establish clear uniform standards for metric educational materials; and
2) a coordinated teacher training strategy, with direct communication links with teachers and provisions for feedback on metric curriculum materials.

3/79:JV

Author:
Ashlock, R.B. and Herman, W.L. Jr. (Eds.).

Accession Number:
M A 0 0 7

Title:
Current research in elementary school mathematics. New York: Macmillan, 1970.

Availability:
The Macmillan Publishing Co.
866 Third Avenue
New York, N. Y.

Cost: $7.25 (paper)

Abstract:

This book collects a number of reports of original research in elementary school mathematics. Reports are grouped into eight sections: research perspective, mathematics learning, selecting methods and materials, improving problem solving ability, planning for individuals, developing curricula, evaluating instruction and achievement and providing teacher education.

Three research reviews included in book are abstracted in this bibliography.

3/79:JV

Author:
Balka, D.S.

Accession Number:
M A 0 2 8

Title:
Creative ability in mathematics. The Arithmetic Teacher 21:633-636, 1974.

Availability:
NCTM
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Abstract:

This paper reviews procedures that have been used during recent years to measure creativity in general and creativity in mathematics specifically. These measures were used in elementary school especially upper elementary and junior high school. Eight references dating from 1964 to 1974, are listed, including four dissertations.

The research indicates the importance of using divergent, no-fixed-response type items in measuring creativity. These divergent-type items are scored for three factors:

1) fluency - the total number of relevant responses made;
2) flexibility - the total number of ideas expressed (this is not necessarily the same as the fluency score); and
3) originality - determined by considering the uniqueness of the idea. A high fluency score does not necessarily indicate high creative ability; however, a high fluency score accompanied by a high flexibility score may give a better indication of creative ability in mathematics, because students who have high flexibility scores can see adjustments and changes in a given mathematical situation and can use this knowledge in responding to the problem.

The author advises teachers to use divergent, open-ended type items in an effort to identify and encourage students who have potential creative ability in mathematics. He also points out the need for better tests and inventories to measure creativity.

Author:
Begle, E.G.

Accession Number:
M A 0 5 6

Title:
Ability grouping for mathematics instruction. A review of the empirical literature SMESG Working Paper No. 17. Stanford, California: Stanford University, Stanford Mathematics Education Study Group, 1975. (ERIC Document Reproduction Service No. ED 116938). 55 pp.

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: HC $3.50
MF $0.38

Order No. ED 116938

Abstract:

This paper examines the research literature concerning the effects of homogeneous vs heterogeneous ability grouping on the mathematical achievement and attitudes of students. The studies examined include all grade levels from 1 through 12, and relate to grouping on the basis of general ability and on the basis of prior mathematical achievement. Differential effectiveness of grouping patterns on students of high, middle and low ability is examined. Grouping within individual classrooms is also discussed.

On the basis of the analysis of the literature, three recommendations are made:
1) school systems should be encouraged to experiment with homogeneous grouping;
2) teachers should be encouraged to experiment with grouping students within the classroom; and
3) research on team-teaching should be done.

The second part of this paper provides an annotated bibliography. Seventy-seven research reports related to ability grouping are annotated. For each report bibliographic information, a summary of the research methods, and a list of findings are provided.

Author:
Begle, E.C.

Accession Number:
M A 007 C

Title:

Curriculum research in mathematics. In R. B. Ashlock and W. L. Herman, Jr. (Eds.), Current research in elementary school mathematics. New York: Macmillan, 1970.

Availability:
The Macmillan Publishing Company
866 Third Avenue
New York, N.Y. 10022

Cost: $7.25 (paper)

Abstract:

The author proposes a theoretical framework for examining developments in curriculum research in mathematics. Three aspects of the framework are discussed:

1) the mathematical content of the curriculum;
2) the theory of learning upon which the curriculum is based; and
3) the application of the content to problem solving.

In reviewing the research done in each aspect of the proposed framework, the author concludes that more fundamental research in mathematics education must take place before substantial improvements in learning and teaching can occur. As a first step, he proposed constructing a battery of instruments which measure understanding of mathematical concepts.

2/79:JV

Author:

Begle, E. G. and others.

Accession Number:

M A 1 1 1

Title:

Review of the Literature on Team-Teaching in Mathematics. Teacher Corps Mathematics Work/Study Team. Working Paper No. 3. Stanford University, Cal. 1975. 16 pp.

Availability:

ERIC Document Reproduction Service
P. O. Box 190
Arlington, VA 22210

Cost: MF $0.83
HC $1.67

Order No. ED 138 548

Descriptors:

Academic achievement, classroom research, elementary school mathematics, literature reviews, mathematics instruction, secondary school mathematics, team teaching.

Abstract:

This document is a collection of abstracts of research studies on team teaching in mathematics. The research reviewed for this paper revealed little difference between team teaching and traditional instruction. Some trends suggested by the literature review are summarized according to grade level - elementary, junior high, or post-junior high. The majority of available research dealt with elementary school students. When studies indicated significant differences in pupil achievement, the traditional classroom was favored. In studies that investigated attitudes, teachers were found to prefer team-teaching. In the junior high setting, it was found that traditionally taught pupils performed significantly better than team-taught pupils in one study, and no significant differences were found in other studies. It was discovered that students preferred the traditional classroom, although evidence also suggested that team-teaching improved the self-concept of some pupils. Only one study involved education beyond the junior high level - in a college algebra course, no significant difference was found between traditional and team teaching.

3/79:JV

Author:
Beilin, H.

Accession Number:
M A 0 0 2 B

Title:
The training and acquisition of logical operations. In M. F. Rosskopf, L.P. Steffe,& S. Taback (Eds.), Piagetian cognitive - development research and mathematical education. Reston, Va.: National Council of Teachers of Mathematics, 1971.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Va. 22091

Cost: $6.75

Order No. 73

Abstract:

This article reviews the research related to training children to develop conservation and logical operations. Approximately 90 studies are referenced; the most recent is dated 1970.

Results from diverse studies show that training makes possible an improvement in performance in practically every type of logical operation. Further, a wide variety of methods lead to improvement in performance.

In discussing the implications of Piagetian research for mathematical education, the author points out that while Piagetian research has shown how complex a process the growth of mathematical concepts can be, it has not demonstrated how it can be made easier.

Author:

Bell, M., Esty, E., Payne, J.N., and
Suydam, M.

Accession Number:

M A 0 4 2 (B)

Title:

Hand-held calculators: Past, present and future. In F. J. Crosswhite and R. E. Reys (Eds.), Organizing for Mathematics Instruction (1977 Yearbook), Reston, Virginia: National Council of Teachers of Mathematics, 1977., 256 pp.

Availability:

National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $11.25

Order No. 18

Abstract:

This essay presents an overview of recent reports, conferences, and programs that have dealt with hand-held calculators. Policy issues and suggestions for needed research are included throughout. No definitive information exists regarding the extent and nature of ongoing research concerned with hand-held calculators. Areas identified as needing research include:

1) how the calculator can best be used to develop and reinforce mathematical skills and ideas;
2) the effect of using calculators with specific content and curricula, including the effect of curricular sequences and changes of emphasis; and
3) the uses of mathematics needed by children and adults, given widespread availability of calculators.

Author:
Brainerd, C.J.

Accession Number:
M A 0 1 9 D

Title:
Analysis and synthesis of research on children's ordinal and cardinal number concepts. In R.A. Lesh and D.A. Bradbard (Eds.), Number and measurement: Papers from a research workshop. Athens, Georgia: University of Georgia, 1976. (ERIC/SMEAC Information Reference Center No. 240M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: HC $12.71
MF $ 0.83

Order No. 240M

Abstract:

This paper reviews selected literature on "the developmental and functional relationships between ordinal, cardinal and natural numbers." The author stresses his own interpretative framework, "the ordinal theory of number development." The reference list includes 32 books, journal articles, and research studies. The most recent is dated 1975.

Research findings suggest that "during elementary school years, ordinal number is more closely connected with the initial emergence of arithmetic." Data also indicate that cardinal skills are very difficult for children to comprehend, while ordinal ideas are comparatively easy for them to understand. "Yet, the method of teaching meanings of arithmetic concepts that currently predominates is a purely cardinal one."

Based on these data, the author suggests eliminating the theory of classes or "set theory" from arithmetic curricula by replacing cardinal definitions of arithmetic concepts with ordinal definitions. The author proposes the following topics for further research:

1) "ordinal and cardinal skills of pre-schoolers;"
2) "preconceptual skills of perceived ordinality and perceived cardinality during infancy;"
3) "when perceived ordinality and perceived cardinality first appear;" and
4) "the educational ramifications of research reviewed in this paper.

3/79:JV

Author:
Brant, V., and Cox, G., DeVenney, W.S., Hoffman, R.I., Johntz, W.F., Mendelsohn, M., Scott, J.L., Sharron, S., and Strobel, L.R.

Accession Number:
M A 0 0 1 B

Title:
Promising programs and practices. In The slow learner (Thirty-fifth yearbook). Reston, Virginia: National Council of Teachers of Mathematics, 1972, 528 pp.

Availability:
NationalCouncil of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $16.90

Order No. 14

Abstract:

In this chapter various persons describe the programs with which they are or have been associated. These programs have been found to have promise, at least in working with certain groups of slow learners or, as in one case, in training teachers of slow learners. In selecting the programs to be included in the chapter, the editorial panel made an attempt to choose them so as to present a variety of philosophical and curricular approaches to working with various groups of slow learners.

Author:
Brown, K.E., Abell, T.L.

Accession Number:
M A 0 7 5

Title:
Analysis of research in the teaching of mathematics, Washington, D.C.: Office of Education, 1965. (ERIC Document Reproduction Service No. ED034689), 99 pp.

Availability:
ERIC Document Reproduction Service
P.O. Box 190
Arlington, Virginia

Cost: HC $4.67
MF $0.83

Order No. ED 034389

Abstract:

This is the sixth in a series of publications prepared by the U. S. Office of Education which are concerned with an analysis of research in mathematics education. This publication presents a summary analysis of research in mathematics education and includes reports of Cooperative Research Projects supported by the Cooperative Research Program of the U.S. Office of Education for the years 1961 and 1962. The reports deal with elementary school, high school and college mathematics and includes 111 doctoral dissertations, 41 master's theses, and 22 non degree studies. A total of 48 of these studies deal primarily with elementary school mathematics.

Analysis of the research on elementary school mathematics indicates that "many young children can learn more mathematics than has been expected of them, but because of differing abilities and differing background, not all of them can learn the same things at the same age." Similarly, most techniques or aids in learning studied did seem to help some pupils but "research has given little direction as to which students and with which concepts any given multisensory aid should be used." The same lack of direction exists for research on grouping and the best method of teaching a particular skill or concept. (Resources in Education/Authors/K.G.)

Author: **Accession Number:**

Burrows, J.K. M A 1 0 7

Title:

A Review of the Literature on Computational Errors with Whole Numbers.
Vancouver, Canada: British Columbia University. 1976. 55 pp.

Availability: Order No.: ED 134 468

Mathematics Education Diagnostic and Instructional Centre
Faculty of Education
University of British Columbia
2075 Wesbrook Place
Vancouver, B.C. V6T 1W5 Canada

Descriptors:

Algorithms; Basic Skills; *Elementary School Mathematics; Elementary Secondary Education; *Error Patterns; Mathematics Education; Research; *Research Reviews (Publications); Whole Numbers.

Abstract:

Research on error patterns associated with whole number computation is reviewed. Details of the results of some of the individual studies cited are given in the appendices. In Appendix A, 33 addition errors, 27 subtraction errors, 41 multiplication errors, and 41 division errors are identified, and the frequency of these errors made by 352 children in grades three through six is tabulated. Appendix B records the 68 errors in multiplication made by 2,100 students in grades four through six. Appendix C lists 57 errors in long division with a one-digit divisor made by 453 children in grades five through eight. In Appendix D, the twelve difficulties most often noted for each of the four operations are identified and responses of 516 children from grades four through eight are tabulated. Appendix E gives examples of six types of errors for addition, subtraction, and multiplication and four types of errors for division. Appendix F records the persistence of errors made by a group of 221 fourth graders learning division when the division was a 2-digit number. Appendix G gives examples of the common computation errors which children make in computing with whole numbers.

3/79:JV

Author:

Callahan, L.G. and Glennon, V.J.

Accession Number:

M A 0 3 5

Title:

Elementary School Mathematics: A guide to current research (4th ed.). Washington, D.C. Association for Supervision and Curriculum Development, 1975, 188 pp.

Availability:

Cost: $5.00 (paper)

Association for Supervision and Curriculum Development
1701 K Street, N.W., Suite 1100
Washington, D.C. 20006

Abstract:

The monograph presents summaries of research in aspects of mathematics of interest to teachers and supervisory personnel in elementary and middle schools.

The monograph is organized into four parts: studies concerning the curriculum,studies concerning the child, studies concerning the learning environment and studies concerned with the teaching process. An extensive reference list is included.

The format of the book is a series of questions and answers. Answers to questions are wherever possible research-based; however, the authors point out that there are many questions that have not been researched in an empirical way but are included...because of their importance to school personnel who must make wise decisions involving the school mathematics program.

Author:

Campbell, Patricia F.

Accession Number:

MA110

Title:

Literature Review: Research on Children's Comprehension of Pictures. PMDC Technical Report No. 5. Tallahassee: Florida State University Project for The Mathematical Development of Children, 1976. 64 pp.

Availability:

ERIC Document Reproduction Service
P. O. Box 190
Arlington, VA 22210

Cost: MF $0.83
HC $3.50 + postage

Order No. ED 144 804

Descriptors:

Elementary School Mathematics, Mathematical Concepts, Perception, Pictorial Stimuli, Research Reviews (Publications).

Abstract:

Research literature concerning children's comprehension of pictures was compiled in order to clarify the role of textbook-type pictures in primary school children's learning of mathematics. The review is presented in eight sections:

1) psychological studies which investigated the role of imagery, comparing pictures with words, including (a) paired-associate tasks and (b) recall and/or recognition tasks;
2) sequence of studies investigating children's interpretation of progressively changing pictures;
3) characteristics of pictures;
4) children's picture perception;
5) children's picture preference;
6) children's ability to perceive depth in pictures;
7) relationship between pictures and reading skills of children from pre-school through intermediate grades; and
8) the influence of pictures on the perception of mathematical relationships in primary school mathematics and on the solution of algebra word problems.

In addition to a summary for each section, abstracts are provided for each study.

Author:
Carpenter, T.P.

Accession Number:
M A 0 1 9 A

Title:
Analysis and synthesis of existing research on measurement. In R. A. Lesh and D. A. Bradbard (Eds.), Number and measurement: Paper from a research workshop. Athens, Georgia: University of Georgia, 1976. (ERIC/SMEAC Information Reference Center No. 240M)

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: HC $12.71
MF $ 0.83

Order No. 240M

Abstract:

This paper discusses the issue of "whether the conceptual development of measurement in young children parallels the logical development of the measurement process." The primary focus of this paper is the measurement research based on the studies of Piaget and his associates. The references include 107 Journal articles, dissertations and books; the most recent citation is dated 1974.

The research suggests that "premeasurement concepts become operational before measurement concepts do; however, research also indicates that children can and do attend to selected measurement concepts before premeasurement concepts are fully operational." Research also suggests that training can accelerate development, but studies have not identified the specific mechanisms of development of measurement concepts.

The author concludes that there is little direct research relating the results of clinical studies to measurement instruction in the mathematics curriculum.

3/79:JV

Author:
Carpenter, T.P. and Osborne, A.R.

Accession Number:
M A 0 1 9 B

Title:
Needed research on teaching and learning measure. IN R.A. Lesh and D.A. Bradbard (Eds). Number and Measurement: Papers From a Research Workshop. Athens, Georgia: University of Georgia, 1976. (ERIC/CSEAC Information Reference Center No. 240M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: $12.71 HC
$ 0.83 MF

Order No. 240 M

Abstract:

This paper discusses the need for a model or unifying conceptual basis that will accommodate questions and problems concerning a variety of measure systems. The reference list cites 26 journal articles, dissertations and books; the most recent citation is dated 1975.

The authors suggest that "the homomorphic nature of measure systems coupled with the psychological processes of transfer:

1) appears to possess a significant potential for revealing additional important factors in studying children's acquisition and understanding of measure systems;"

2) "appears to provide a mechanism for studying cognitive processes," and

3) "appears to be directly related to instructional questions and problems of significance to teachers."

The author concludes that basic research concerning measurement concepts needs to be channeled in order to "generate a predictive model (of cognitive development) that can identify the sequence of acquisition of different tasks and can be used to evaluate the effect of instruction for children at different levels of development."

3/79:JV

Author:
Cathcart, W. George (ed.)

Accession Number:
M A 0 8 7

Title:
The Mathematics Laboratory: Readings from The Arithmetic Teacher,
Reston, VA, National Council of Teachers of Mathematics, 232 pps., 1977.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091

Cost: $ 6.20

Order No. 59

Abstract:

Forty articles providing history, descriptions, rationalizations, and recommendations concerning the use of the mathematics laboratory in the elementary school. The articles are grouped under nine headings: "The Mathematics Laboratory: what?", "The Mathematics Laboratory: why?", etc., through "The Mathematics Laboratory: how? (evaluation)."

Author:
Cooney, J.J., and Bradbard, D.A. (Eds.)

Accession Number:
M A 0 7 6

Title:

Teaching strategies: Papers from a research workshop. Athens, Georgia: University of Georgia, 1976. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 244M), 209 pp.

Availability:

ERIC/SMEAC Information Reference
The Ohio State University
1200 ChambersRoad - Third Floor
Columbus, Ohio 43212

Cost: $4.00

Order No. 244 M

Abstract:

Nine papers presented at a research conference on strategies for teaching mathematics are presented in this volume. The first paper provides an overview of research on teaching strategies, defining a perspective on the subsequent papers. The second paper reviews the major strategies from a historical perspective. The third paper discusses the role of a theory in the development of teaching strategies. Four papers are concerned with research problems related to teaching strategies. The first of these deals with studies of efficacy of different strategies; the second concerns a comparison of teaching strategies which differed in the amount of information being taught and the amount of pupil-teacher interaction. More general research papers concern problems of designing studies of teaching strategies and a context for studying teaching strategies from a delivery-systems approach. The eighth paper discusses materials for teacher training. The final paper provides an integrative summary of research on teaching strategies.

Author:	Accession Number:
Copeland, R.W.	M A 044

Title:

How children learn mathematics: Teaching implications of Piaget's research (2nd ed.) New York, Macmillan, 1974, 374 pp.

Availability:	Cost: $13.95

Macmillan Publishing Co., Inc.
866 Third Avenue
New York, N.Y. 10022

Abstract:

This book presents teaching implications based on Piaget's research on how children learn mathematics. It includes the most recently available research conducted by Piaget as well as incorporating information based on books recently written or translated into English.

The two major purposes of this book are diagnostic - an aid in discerning a child's stage of development in order to determine the type of mathematics for which the child is ready; and as a methods book in teaching mathematics.

Chapter 18 provides detailed guidelines for establishing a mathematics laboratory in the classroom. This chapter should be particularly useful for teachers who want to implement Piaget's findings.

2/79:JV

Author:

Crosswhite, F.J., and Reys, R.E. (Eds.).

Accession Number:

M A 0 4 2

Title:

Organizing for mathematics instruction (1977 Yearbook). Reston, Va.: National Council of Teachers of Mathematics, 265 pp.

Availability:

National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $11.25

Order No. 18

Abstract:

This book discusses alternative teaching approaches such as individualization, survival groups, stimulations, open schools, and others; and emphasizes how to organize for such approaches. It deals with all levels of instruction and gives specific illustrative examples. A nonthematic essay on hand-held calculators is also included.

Specific chapters dealing with implications for teaching based on research in self-paced mathematics instruction and a review of reports on the use of hand-held calculators in mathematics instruction are abstracted in this bibliography under Bell, M., *et. al.*, "Hand-held calculators: past, present and future," and Schoen, H., "Implications of research for instruction in self-paced mathematics classrooms."

Author:
Dunn, J.A.

Accession Number:
M A 0 3 8

Title:

Tests of creativity in mathematics. International Journal of Mathematical Education in Science and Technology, 6:327-332, 1975.

Availability:

Taylor & Francis Ltd.
10-14 Macklin St.
London, WC2B 5NF
England

Cost: $50.00 - annual

(quarterly publication)

Abstract:

This article describes the kinds of tests developed to measure creativity in mathematics. In reviewing 32 studies published between 1959 and 1973, the author concludes that measures being used to measure creativity reflect an ambivalance about what creativity in mathematics means.

Two kinds of tests are being used as measures of creativity. One kind is used to identify the mathematically talented. In research studies, instruments of this type are used to try to determine what relationships exist between creativity in mathematics and general creativity or intelligence or some other measure. In schools, these measures are used to make decisions about student placement in different kinds of programs in mathematics. Typical items on these tests ask students to produce many solutions to a single problem (write as many true equations as you can using the numbers 2, 3, and 8 and their signs +, -, x, and ÷). A second type of creativity measure is used to assess achievement made by students in discovery-based programs in mathematics.

According to the author, assessment procedures in creativity are still in their infancy, and, as yet, in terms of recognizable relevant criteria, no widely accepted definition of creativity exists.

Author:

Easley, J.A., Jr.

Accession Number:

M A 0 9 4

Title:

On Clinical Studies in Mathematics Education. Columbus, Ohio; Ohio State University, 1977. 40 pp.

Availability:

ERIC/SMEAC
Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

Cost: $1.25 (offset special bound)

Order No. 254M

Abstract:

This report intends to provide some perspectives on the use of case studies and other clinical approaches in mathematics education.

Much of the paper contrasts several research strategies, discussing in some detail the procedures - and some of the results - of three distinctive types of studies. The perspectives and the premises of Erlwanger, Piaget, and some Soviet studies are considered in relation to the techniques and outcomes which result from their work. The uses of clinical research in the classroom are discussed - both the use of research results and of research methods. One hundred twenty-two annotated references are cited; the most recent is dated 1977.

Author:

Fennema, E.

Accession Number:

M A 0 3 0

Title:

Mathematics learning and the sexes: A review. Elementary School Journal, 1974, 75, 183-190.

Availability:

University of Chicago Press
5835 Kimbark Ave.
Chicago, IL 60637

Abstract:

Reviewed are thirty-six studies reported between 1962 and 1972 on differences in mathematical achievement between boys and girls. Studies are sorted into pre-school, early elementary, upper elementary, and high school categories to synthesize the results.

Major findings include:
1) there are no significant differences between the sexes in mathematics achievement during pre-school and early elementary years;
2) significant differences are not always apparent in upper elementary and early high schools years; and
3) when significant differences do appear they tend to be in boys' favor when higher level cognitive tasks such as mathematical reasoning are being measured, and in girls'favor if lower level cognitive tasks such as computational ability and fundamentals are being measured.

The author feels that the review has left several questions unanswered including:
1) What, if any, differences in mathematics achievement are there in high schools?;
2) What sex-related factors influence mathematics achievement and are these factors inherent or environmental?; and
3) Is there "sexism" in mathematics education or in mathematics-education research and its reporting?

3/79:JV

Author:
Fennema, E.

Accession Number:
M A 0 6 3

Title:
Mathematics, spatial ability and the sexes. Paper presented at the annual meeting of the American Educational Research Association, Chicago. April, 1974. (ERIC Document Reproduction Service No. ED 089998)

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: HC $1.67
MF $0.83

Order No. ED 089 998

Abstract:

This report defines spatial ability operationally (consisting of three components) and reviews possible sex differences in this ability as reported in the literature. The relationship between mathematical ability and spatial ability is discussed. The reference list includes 32 journal articles, books and papers; the most recent citations were dated 1973.

The author concludes that spatial ability is only one factor which may contribute to mathematics achievement. However, research suggests that "if a mathematics test includes many items that require spatial ability to solve, girls will not do as well as boys." The author suggests that an interesting study would be to develop a mathematics test that had little or no spatial content and compare the sexes on achievement. The author does feel that spatial ability as a factor in mathematics achievement warrants further investigation.

Author:
Fennema, E.

Accession Number:
M A 0 2 7

Title:
Models and mathematics. The Arithmetic Teacher 19:635-640, 1972.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Abstract:

Presented is a review of sixteen studies on the role of concrete and symbolic models in facilitating the learning of mathematical ideas in elementary school. Twenty-four references are cited; the most recent dated 1969.

Research findings indicate that:
1) learning of mathematical ideas is facilitated by more concrete models in the early grades and a gradually increasing proportion of symbolic models as children progress to the upper elementary grades;
2) the ratio of concrete to symbolic models used to convey mathematical ideas should reflect the developmental level of the learner; and
3) symbols must represent actions the learners have done previously (i.e., they must be consistent with both the developmental and experiential background of the children).

Based on the research findings the author suggests that teachers should allow children to choose from alternative types of models whenever they are asked to solve a problem and carefully observe children and attempt to determine which models are not meaningful and to determine which models are most meaningful and acceptable to the children concerned. The author feels that using concrete and symbolic models in the way suggested will better enable children to apply their learning to new situations and also to more easily acquire comprehension of the highly abstract content of advanced mathematics.

Author:
Fennema, E.

Accession Number
M A 0 1 6

Title:
Sex differences in mathematics learning: Why??? Elementary School Journal, 75:183-190, 1974.

Availability:
University of Chicago Press
5833 Kimbark Ave.
Chicago, IL 60637

Cost: $14.00 annum
monthly

Abstract:

This document presents a brief discussion of the experimental literature pertaining to the apparent sex differences in mathematics learning after fourth grade. Thirty-four references are cited, with the most recent citation dated 1974. Topics discussed are inherent factors, spatial ability, verbal ability, attitudes, self-concept and perceived sex role in mathematics.

The author concludes with recommendations for study and research in spatial visualization and sex role expectations as they influence mathematics achievement. Also included are questions that teachers should ask themselves to determine if they are directly or indirectly influencing the sex role differences through expectations or the type of instructional materials used for mathematics.

Author:
Fennema, E. and Sherman, J.

Accession No.
M A 0 5 1

Title:
Sex-related differences in mathematics learning: Myths, realities and related factors. Paper presented at the annual meeting of the American Association for the Advancement of Science, Boston, Mass., February, 1976, 24 pp. (ERIC Document Reproduction Service No. ED 129633).

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: MF $ .83

Order No.
ED 129633

Abstract:

This document discusses research concerned with the differences in mathematical achievement of males and females. Variables hypothesized to be related to achievement of women in general and to mathematics learning and studying in particular are considered: verbal ability; spatial visualization ability; confidence in learning mathematics; mathematics as a male domain; attitude toward success in mathematics; perceived attitudes of mother, father, and teachers toward one as a learner in mathematics; usefulness of mathematics; and effective motivation in mathematics. The list of references includes 38 citations; the most recent one dated 1976.

Most of the research reported deals with high school age students; however, some conclusions that may apply to all age groups are:
1) sex-related differences in mathematics achievement are not universal;
2) the relationship between cognitive factors and differential learning of mathematics by the sexes is unclear; and
3) differential mathematics studying and mathematics achievement by the sexes is at least partially caused by socio-cultural factors mediated through sex-role expectations.

3/79:JV

Author: Fitzgerald, W.M.	Accession Number: MA065

Title:
About mathematics laboratories, East Lansing, Michigan: Michigan State University, 1972. (ERIC Document Reproduction Service No. ED 056895)

Availability: ERIC Document Reproduction Service P.O. Box 190 Arlington, Virginia 22210	Cost: HC $2.06 MF $0.83 Order No. ED 056895

Abstract:

This paper traces the growth of the concept of a mathematics laboratory and reviews recent research and developments in this field. The list of references includes 41 Journal articles, dissertations and books; the most recent citation is dated 1970.

The author concludes that, in his opinion, the best way to teach mathematics is in a more activity-oriented approach which is more individualized, makes mathematical concepts more meaningful and their applications more reasonable, as well as to "nurture the healthy natural development of intellect in children", is through the implementation and use of mathematics laboratories.

Author:
Fitzgerald, W.M., and Higgins, J.L. (Eds.)

Accession Number:
M A 0 7 7

Title:

Mathematics laboratories: Implementation, research, and evaluation. Columbus, Ohio: Ohio State University, 1974. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 231M)

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $2.10

Order No. 231M

Abstract:

This publication reviews the mathematical laboratory from three perspectives: a practical view of laboratories in operation, a review of related research, and a view of current laboratory evaluation procedures. After a discussion of definitions, types, and purposes of math labs, the first paper concentrates on their historical development in Philadelphia, Pennsylvania, from their inception in 1967 through 1972. Despite continued interest throughout this period, actual numbers declined rapidly after 1970. Several reasons for this decline are cited. Several projects are reviewed; specifically discussed are problems, solutions, and results. Although generally pessimistic regarding the future of math labs, the author mentions several innovative movements as possible reversing trends. The second paper reviews research on math labs and activity learning, describes ways to employ math labs most effectively and discusses some apparent effects on student achievement and attitudes (specifically, achievement gains in less able elementary children, with no effect on attitudes). This paper is followed by an extensive bibliography. The third paper critically analyzes seven specific project evaluations--their data collection techniques, types of analyses, and results. Following a discussion of difficulties encountered, the author makes some suggestions, based on the need for individually tailored evaluations.

A more detailed summary of the second paper, which reviews research on math labs is provided in this bibliography under Wilkinson, J.D. "A review of research regarding mathematics laboratories".

Author: **Accession Number:**

Fox, Lynn H., Fennema, Elizabeth, and Sherman, Julia: M A 0 9 9

Title:

Women and Mathematics: Research Perspectives for Change. (Number 8 in NIE Papers in Education and Work). Washington, D.C., 1977, 206 pp.

Availability:

National Institute of Education
U. S. Department of Health, Education and Welfare
Washington, D.C. 20208

Abstract:

The three papers included in this volume investigate current research to locate major influences on girls' achievement and participation in mathematics. Each includes scholarly, analytical reviews of the most current research and is accompanied by a detailed, annotated bibliography. Fennema's article studies the major cognitive, affective, and educational influences. Fox studies major social influences and Sherman investigates evidence related to hypotheses of biological sources as major influences of differences in mathematics achievement.

The underlying theme of all three papers is the finding that sex differences in mathematics achievement are largely a function of differential course-taking rather than any inability on the part of women to learn mathematics.

The authors make recommendations for new research: Sherman stresses the need for broad-based research on the cognitive development of females. Fennema recommends interdisciplinary research teams of scholars and practitioners, longitudinal studies, and interrelated (rather than independent) studies. Fox recommends that intervention programs aimed at increasing girls' participation in mathematics should be evaluated to identify successful components.

Author:
Gerling, Max and Wood, Stewart.

Accession Number:
M A 1 0 9

Title:
Literature Review: Research on the Use of Manipulatives in Mathematics Learning. PMDC Technical Report No. 13, Tallahassee: Florida State University Project for the Mathematical Development of Children. 1976. 58 pp.

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, VA 22210

Cost: MF $0.83
HC $3.50 + postage

Order No. ED 144 811

Descriptors:
Activity Learning, Elementary School Mathematics, Literature Reviews, Manipulative Materials, Mathematical Concepts, Research Reviews (Publications).

Abstract:
Research reported primarily from 1970 through 1975 on the use of manipulative materials at the elementary level (K-7)is reviewed. The research is categorized as design-oriented research, content-oriented research, and catalogs of manipulatives. Each section contains a summary followed by abstracts for each study. References to the theoretical foundation and historical background on the uses of materials, discussions of advantages and disadvantages, and comparisons of specific materials are also included.

3/79:JV

Author:
Gow, Doris T.

Accession Number:
M A 1 1 3

Title:
A Synthesis of Research in Basic Skills. University of Pittsburgh, Learning Research and Development Center, 1977, 64 pp.

Availability:
Learning Research and Development Center
University of Pittsburgh
Pittsburgh, PA

Abstract:
This is the report of a literature search undertaken for The Pennsylvania School Improvement Program. The intent of the search is not only to help schools identify their needs and select and implement research and development outcomes to meet those needs, but also to develop and establish a more rational procedure than has been used for decision-making by educators. Information was collected and organized under four constructs of the Cooley-Lohnes Model of classroom processes (i.e. opportunity, motivators, structure, and instructional events) supplemented by the categories, student and teacher characteristics, which seemed particularly relevant to the PSIP. Implications for practice in teaching math and reading are summarized. One hundred twenty-two references are cited; the most recent is dated 1977.

3/79:JV

Author:
Graeber, Anna O. and Baxter, Katherine B.

Accession Number:
M A 1 0 1

Title:
Math Diagnosis and Prescription Literature Search: Final Report. Philadelphia, PA : Research for Better Schools, Inc. 1976. 42 pp.

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, VA 22210

Cost: MF $0.83
HC $2.06 + postage

Order No.: ED 139 663

Descriptors:
Educational Diagnosis, Elementary School Mathematics, Literature Reviews, Annotated Bibliographies, Basis Skills, Bibliographies, Elementary Secondary Education, Error Patterns, Instruction, Mathematics Education, Research Reviews.

Abstract:

The procedures used for locating documents on diagnosis and prescription in mathematics are described, and the coding system used in reporting the documents is explained. Appendices include lists of basic documents, basic sources, frequently cited authors, and relevant phrases and concepts; a partial bibliography of documents concerned with diagnosis and prescription in mathematics; and outline of document codes; and an annotated bibliography of selected documents.

Author:
Helms,D. and Graeber, A

Accession Number:
M A 0 2 0

Title:
Problems related to children's acquisition of basic skills and learning of mathematics (RBS AD-2). Research for Better Schools, Inc., 1975.

Availability:
Publications Office
Research for Better Schools, Inc.
1700 Market Street
Philadelphia, PA 19103

Cost:

Order No.: AD-2

Abstract:

The authors offer their own observations on some of the problems children have in acquiring basic skills, with a special emphasis on mathematics. The bibliography includes seven references; the most recent dated 1975.

The authors' observations include the following:
1) one explanation for the failure of the new math may be that the mathematical heuristics (i.e. set notations, associative and commutative and distributive symbolic manipulations, etc.) frequently hinder students' understanding rather than helping it;
2) mathematics should be relevant to the experience of the learners;
3) instruction can only be effective to the extent that the teacher is successful in matching learners with appropriate types or methods of instruction; and
4) many teachers do not possess many of the skills necessary for effective program management.

Based on these observations, the authors suggest several ideas for future research including:
1) a study of the effectiveness of the mathematical heuristics of the new math in terms of the degree to which they promote understanding;
2) a study of what content should be offered in math, when (i.e. what grade level), and for how long, and also making consideration for individual student's competency and needs; and
3) a study to determine the necessary program management skills, adequacy of pre-service preparation of teachers in these skills, and effective means for their instruction.

Author:
Higgins, Jon L. and Heddens, James W. Eds.

Accession Number:
M A 1 1 4

Title:
Remedial Mathematics: Diagnostic and Prescriptive Approaches. Columbus, Ohio: ERIC Center for Science, Mathematics, and Environmental Education, 1976, 134 p.

Availability:
ERIC Center for Science, Mathematics, and Environmental Education
College of Education
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $3.50 (offset with cover)

Order No. 251 M

Abstract:
The papers in this publication were developed from speeches and reactions presented at the first National Conference on Remedial Mathematics held at Kent State University in May, 1974. There are five pairs of papers; the second in each pair is a reaction to the first. A conference summary is the concluding paper. The five topics are:
1) Identifying and describing the remedial mathematics student;
2) Classroom diagnosis;
3) Clinical diagnosis of children with mathematics' difficulties;
4) The diagnostic process in mathematics instruction; and
5) Remediation of learning difficulties in school mathematics: promising procedures and directions.

Author:
Howson, A.G. ed.

Accession Number:
M A 0 0 4

Title:
Developments in Mathematical Education: Proceedings of the Second International Congress on Mathematical Education, Cambridge University Press, Great Britain, 1973, 318 pp.

Availability:

Cambridge Press
32 E 57th Street
New York, NY 10022

Cost: $7.95

Abstract:

Collection of papers with theoretical emphasis. Themes include concern for the relationship between mathematics and the way in which the formation of mathematical concepts is affected by the use of language or the means in which Children form the concepts from which math can be drawn. Also concerned with the relationship between mathematics, the uses to which it is put and the artistry with which it is developed. Heavy emphasis on the use of manipulables.

2/79:JV

Author:
Junge, C.W., Campbell, P., and Denmark, T.

Accession Number:
MA054

Title:
Mathematics for young children. A summary of research and related literature. Tallahassee, Florida: Florida State Department of Education, Early Childhood and Elementary Education Section, 1975. (ERIC Document Reproduction Service No. ED 120026.

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Reston, Virginia 22210

Cost: HC $2.06
MF $0.83

Order No. ED 120026

Abstract:

This booklet provides an annotated list of 48 research reports related to mathematics teaching and learning of primary school children, and a bibliographic listing of 102 additional papers dealing with these topics. Each bibliography is organized into five major divisions:
1) growth and development of children;
2) development of mathematical thought in children;
3) mathematical content appropriate for young children;
4) strategies of teaching mathematical concepts to young children; and
5) assessment and evaluation of mathematical learning.

Author:
Kieren, T.E.

Accession Number:
M A 0 3 6

Title:
Manipulative activity in mathematics learning. Journal for Research in Mathematics Education 2:228-234, 1971.

Availability:
NCTM
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Abstract:

This article presents current theoretical discussions and research efforts related to the use of manipulative activities in mathematics learning. Thirty-two references are cited, the most recent of which is dated 1970.

Theoretical and research interests center about three issues:
1) Does manipulative experience fit best at a certain level or stage of learning or development;
2) what is the role of play-like activities in mathematics learning; and
3) which aspects of manipulative experiences work best in promoting learning?

Theoretical discussions of Piaget, Bruner, and Dienes lend support to the importance of using concrete representations in the elementary grades. Research evidence suggests that in mathematics, the use of symbols or pictures may be a good manipulative activity in terms of achievement. Play-like activities including mathematical rule-based games are thought to be important factors in promoting learning functions to encourage children to try a range of solutions and to seek new information. Finally, theory suggests that a mathematical concept is best developed by a variety of manipulative activities all designed to promote learning of a single concept.

The author believes further research using multivariate techniques is needed.

Author:
Kieren, T.E.

Accession Number:
M A 0 24

Title:
Use of Computers in Mathematics Education Resource Series: Research on Computers in Mathematics Education. Columbus, Ohio: ERIC Information Analysis Center for Science and Mathematics Education, 1973. (ERIC Document Reproduction Service No. ED 077 734.)

Availability:
ERIC/SMEAC - Information Reference Center
Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, OH 43212

Cost: $1.35 (offset cover)

Order No.: 215M

Abstract:
This document centers on research done in three broad areas of computer application:

1) computer-based instruction (students interact with a computer that has been pre-programmed to provide instruction);

2) computer-managed instruction (computer used to select instruction and to monitor student progress; and

3) computer-augmented problem solving (students learn to program and use computers to learn mathematics).

More than 100 references are cited; the most recent reference is dated 1973.

In all three areas there is some empirical support for the use of computers. The evidence is particularly strong in the areas of drill and practice, computer-based instruction and computer-augmented problem solving. There is no evidence in the research cited in the review to suggest teacher displacement by computers.

2/79:JV

Author:
Kilpatrick, J., and Suydam, M.N.

Accession No.:
M A 0 6 0

Title:
Reports on mathematics education literature, 1969-1973. 1974 (ERIC Document Reproduction Service No. ED 092412)

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia

Cost: HC $4.67
MF $0.83

Order No. ED 092412

Abstract:

This document consists of six reports on literature published in the United States each year from 1969 through 1973 on the pedagogy of mathematics. These reports were prepared for the German publication, Zentrablatt Fur Didaktik Der Mathematik. In each report, the literature is briefly reviewed under five categories: mathematics textbooks for teachers, books for professional reading, books on teaching methodology, books on research in mathematics education, and committee and conference reports. Each report contains an extensive list of references.

Author:

Krutetskii, V.A.

Accession Number:

M A 0 0 6

Title:

The psychology of mathematical abilities in school children. (J. Teller, Trans.: J. Kilpatrik and I Wirszup, Eds.). Chicago: University of Chicago Press, 1976. (Original Published, 1968).

Availability:

The University of Chicago Press
5801 Ellis Avenue
Chicago, Illinois 60637

Cost: $22.00

Abstract:

This book presents the results of a twelve-year program of research designed to explore the nature and structure of mathematical abilities. Focussing solidly upon psychological research, it does not "Pretend either to analyze current methods of mathematics instruction or to create a new method."

Chapters 2 and 3 of the book present an extensive review of Western and Soviet literature dealing with mathematical ability. In the remainder of the book, Krutetskii presents his own views, methods and findings regarding mathematical abilities. Based principally on interviews with almost two hundred children who were asked to think aloud as they worked on various mathematical logical problems, Krutetskii concludes that a "mathematical cast of mind", possibly present at birth exists. Further, he identifies three basic types of mathematical cast of mind: the analytic types who think in verbal-logical terms; the geometric types who think in visual pictorial terms and the harmonic types who combine characteristics of both. In solving mathematical problems, Krutetskii presents a three stage process: information getting, processing information and retaining information about the solution.

Author:
Lachat, Mary Ann, Capasso, Ronald, Bartinique, Ingrid.

Accession Number
M A 0 9 1

Title:
Math Programs that Work, A National Survey, 1977, 3rd Edition, 52 pages.

Availability:
Capla Associates, Inc.
Rochelle Park, New Jersey

Abstract:

Prepared under a grant from the New Jersey State Department of Education, this book lists and describes 12 complete and 14 supplementary Mathematics programs, representing different grade levels, but covering, in toto, levels from K through 12.

The book's introduction reports that over 300 programs were considered for inclusion, but that final decisions were "based on available evaluation data that indicated that the programs had demonstrated a positive impact in the classroom."

Author:

Leeds, D.S.

Accession Number:

M A 0 4 8

Title:

Summary of research related to reading in the content areas - science and mathematics. (formerly) Journal of the Reading Specialist: 10:88-95, 1970. (now is called: Reading World)

Availability:

College Reading Association
Shippensburg State College
Shippensburg, PA 17257

Abstract:

This article presents a summary of research findings related to reading in specific content areas, especially science and mathematics. Although the article deals more with secondary school students, it also has relevance for elementary school children. The bibliography includes 27 Journal articles, papers and books. The most recent publication cited is dated 1970.

The research consensus suggests that two of the major difficulties that exist in teaching reading in specific content areas are vocabulary and concept development. The author suggests a "marriage between the reading specialist and the content teacher (e.g. the mathematics teacher), in terms of 'team-teaching', coordinated working or close cooperation" which would benefit both the student and the teachers

Author:
Lesh, R.A., Jr.

Accession Number:
M A 0 3 2

Title:

An interpretation of advanced organizers. Research in Mathematics Education 2:69-74, 1976.

Availability:
NCTM
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Abstract:

The author reviews the research related to the instructional effectiveness of advanced organizers as used with mathematical materials and raises several issues about the function and use of advanced organizers.

Research evidence about the effectiveness of advanced organizers as learning aids is inconclusive. According to the author, inconsistent results may be due to the varying ways in which the concept of advanced organizer has been defined from study to study.

3/79:JV

Author:
Lesh, R.A. and Bradbard, D.A. (Eds.)

Accession Number:
M A 0 1 9

Title:
Number and measurements: Papers from a research workshop. Athens, Georgia, 1976. (ERIC/SMEAC Information Reference Center No. 240M), 238 pp.

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $12.71 HC
$ 0.83 MF

Order No. 240 M

Abstract:

Seven papers presented at a research conference on number and measurement are presented in this volume. The first paper provides an overview of research concerning number and measurement, and suggests directions for future research. The second paper discusses the relationships between measurement and number concepts, and psychological and instructional issues related to transfer. Two papers are devoted to synthesizing and analyzing research on measurement, and the delineation of questions about which research is needed. Two papers are concerned with instruction and research on teaching and learning fractions. The final paper concerns children's development of cardinal and ordinal number concepts.

3/79:JV

Author:
Lovell, K.

Accession Number:
M A 0 2 6

Title:
Intellectual growth and understanding mathematics. Columbus, Ohio: ERIC Information Analysis Center for Science and Mathematics Education, 1971. (ERIC Document Reproduction Service No. Ed 049 069.)

Availability:
ERIC/SMEAC - Information Reference Center
Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, OH 43212

Cost: $0.75 (offset with cover)

Order No.:200M

Abstract:

This paper includes a review of the research done in the past twenty-five years (through 1970) on pupils' intellectual growth and their understanding of mathematical ideas. The author begins by stating six assumptions upon which the paper is based. These assumptions are based on Piaget's theory of cognitive development. Forty-eight references are cited in the bibliography; the most recent dated 1970.

Major findings at the elementary school level include:
1) there is a limited operational use of number to the 8th birthday;
2) a conceptual space emerges from seven years of age onwards in which the child understands spatial properties and relations;
3) the concept of volume in its three aspects, internal volume, volume as occupied by space and complementary or displacement volume is not well understood even at the end of elementary school; and
4) children can use time words, and tell the time, long before they can handle temporal operations.

In general, the author believes that the research provides evidence that it is the development of the "general ways of knowing" that determines the manner in which new knowledge in mathematics is understood.

The author suggestions that elementary schools should be less formal, have more manipulative materials, and provide for more peer interaction

2/27:JV

Author:
Martin, J. Larry, Ed., Bradbard, David A. Technical Ed.

Accession Number:
M A 0 9 3

Title:
Space and Geometry. Papers from a Research Workshop sponsored by the Georgia Center for the study of Learning and Teaching Mathematics and the Dept. of Mathematics Education, University of Georgia, Athens, Ga., 1976. 245 pp.

Availability:
ERIC/SMEAC
College of Education
Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

Cost: $4.25 (offset perfect bound)

Order No.: 245 M

Abstract:
Seven articles by five authors, intended to stimulate dialogue among mathematics educators with the objectives of synthesizing existing knowledge concerning the child's conception of space and geometry and identifying, coordinating, and generating related studies. For example, one of the articles (by Izaak Wirszup) is titled, "Break Throughs in the Psychology of Learning and Teaching Geometry." Focus of the collection is K-6.

Author:
Mayer, R.E.

Accession No.:
M A 0 6 2

Title:
Learning to Solve Problems: Role of instructional method and learner activity. Ann Arbor, Michigan: Michigan University Human Performance Center, 1974. (ERIC Document Reproduction Service No. ED 091225)

Availability:
ERIC Document Reproduction Service
P.O. Box 190
Arlington, Virginia 22210

Cost: HC $3.50
MF $0.83

Order No. ED 091225

Abstract:

This document reviews literature which focuses on the relationship of instructional method, internal cognitive activity and performance measures. This includes literature concerned with the issue of "discovery versus reception learning" and the effects of different instructional methods on retention, delayed retention and transfer tasks. The list of references includes 110 journal articles, books and papers; the most recent citations are dated 1972.

The author concludes from this review that little progress will be made concerning our understanding of the role of instructional method until the emphasis on "which method is best" gives way to an attempt to define and relate to one another, external features of instruction, internal features of subject character and activity during learning, and outcome performance variables

Author:
McGannon, T.

Accession Number:
M A 0 11

Title:
Creativity and mathematics education. School Science and Mathematics, 72:7-12, 1972.

Availability:
School Science and Mathematics Assn. Inc.
Box 1614
Indiana University of Pennsylvania
Indiana, PA 15701

Abstract:

Document summarizes the status of current research on defining and identifying creativity and presents work concerned with identifying the creative student in mathematics. Two studies (1969, 1972) are reviewed to determine whether performance on the High School Mathematics Contest, a traditionally accepted measure of creativity, is related to scores on a test in creativity or to receiving a degree in mathematics.

Results of research indicate that performance in the mathematics contest is not a good predictor of performance on measures of creativity nor of later achievement in mathematics. In light of the findings, the author urges mathematics educators to reconsider the traditional ways used to identify creative students in mathematics.

The author raises the issue of whether mathematics textbooks that present students with problems to solve that are closely related in substance and method to those explained in the book or by the teacher may inhibit the development of creativity by failing to give students adequate practice in attacking new problems in novel ways.

Author:

Miller, R.L.

Accession Number:

MA035

Title:

Individualized instruction in mathematics: A review of research. Mathematics Teacher: 69:345-351, 1972.

Availability:

National Council of Teachers of Mathematics
1906 Association Dr.
Reston, VA 22091

Abstract:

Studies mentioning use of an individualized approach to teaching mathematics and requiring students to proceed through the material at their own rate are reviewed. One hundred forty-five studies, the majority of which were done between 1960 and 1974, are cited. Studies that use computers to individualize instruction are not included.

Major findings and conclusions based on research include the following:
1) individualized instruction is rarely used below grade four;
2) individualized instruction has a limited effect on changing attitudes toward mathematics;
3) about one-third of the studies show some improvement in achievement;
4) there is a very minor trend favoring achievement by low-ability students;
5) studies comparing the rate of learning progress using traditional methods of instruction versus individualized procedures show mixed results;
6) individualized programs tend to be more successful with students who are highly motivated to learn on their own and who voluntarily choose to participate in the program; and
7) there is a steady decline in achievement as the duration of a program increases from less than a semester, to a semester, to a year to more than a year.

2/79:JV

Author: Accession:
National Council of Teachers of Mathematics M A 0 9 0

Title:
Measurement in School Mathematics. National Council of Teachers of Mathematics, Reston, VA 256 pp., 1976 Yearbook

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Availability: Cost: $11.25
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091 Order No.: 17

Abstract:
Sixteen articles, K-12 the intended audience, discussing a range of measurement topics, including the learning and teaching of measurement, K-12; interesting measuring activities with unusual devices; a metric bibliography (most recent listing, 1975); an annotated list of metric teaching aids, with photographs; and a nonthematic essay on how to improve computation with low-stress algorithms.

3/79:JV

Author:
National Council of Teachers of Mathematics

Accession:
M A 0 8 4

Title:
Minicalculators. The Arithmetic Teacher: 23(7) -89, November, 1976.
Special Issue: Minicalculators

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Order No. 65

Abstract:

A special issue of The Arithmetic Teacher devoted to minicalculators and their place in elementary school and junior high mathematics. Guidelines for selection, use, and design of instruction are presented in 12 articles. Sample article titles: "Calculators and the mathematics curriculum;" "Instructional games with calculators;" "Selecting a minicalculator."

3/79:JV

Author:
National Council of Teachers of Mathematics

Accession Number:
M A 0 8 9

Title:
Problem Solving, The Arithmetic Teacher: 25(2)60p., November, 1977.
Special Issue: Problem Solving

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Order No. 78

Abstract:

Eleven articles dealing with various aspects of teaching problem-solving in the primary or middle school classroom: psychological research, ideas, a diagnostic-prescriptive approach for teaching word problems, etc. Sample article titles: "Ideas about problem-solving : a look at some psychological research;" "The right hemisphere's role in problem-solving;" "Research on problem-solving: implications for elementary school classrooms."

Author:
National Council of Teachers of Mathematics

Accession Number:
M A 0 0 3

Title:
The growth of mathematical ideas: Grades K-12 (Twenty-fourth yearbook).
Reston, Va.: National Council of Teachers of Mathematics, 1959, 507 pp.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $15.75

Order No. 3

Abstract:

This yearbook highlights the elements developed and extended throughout the mathematics curriculum in grades K-12 and beyond. Topics developed as separate chapters are number and operations, relations and functions, proof, measurement and approximation, probability, statistics, and language and symbolism in mathematics.

In later chapters suggestions are presented for extending ideas previously presented and for using them in teaching and curriculum planning.

Author:
National Council of Teachers of Mathematics.

Accession Number:
M A 0 0 1

Title:
The slow learner (Thirty-fifth yearbook). Reston, Va.: National Council of Teachers of Mathematics, 1972, 528 pp.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $16.90

Order No. 14

Abstract:
The 35th yearbook of the National Council of Teachers of Mathematics is designed to provide ideas for teaching the slow learner in mathematics. Slow learners are defined only as "students who are not achieving at the desired level".

The book is divided in three parts. The first part includes background information for teachers. Part two supplies specific information for adjusting instruction for the slow learner. The third part deals with administrative and management considerations. Appendices present number games, activities and sample lessons and are included.

The chapters dealing with research findings and existing programs and practices in the field are abstracted in this bibliography under Pikaart, L. and Wilson, J.W. "The research literature," and Brant, V. et. al. "Promising programs and practices."

3/79:JV

Author:
National Institute of Education

Accession Number:
M A 0 8 0

Title:
The NIE Conference on basic mathematical skills and learning-Volume I: Contributed position papers and Volume II: Working group reports.
Euclid, Ohio: U.S. Department of Health, Education and Welfare, 1975.

Availability:
National Institute of Education
1200 19th St. N.W.
Washington, D.C. 20008

Abstract:

Volume I is a compilation of 33 short papers presented at a three-day conference on basic mathematical skills and learning. The conference was sponsored and organized by the Basic Skills Group of the National Institute of Education.

The participants were asked to respond to the following questions:
1) What are basic mathematical skills and learning?
2) What are the major problems related to children's acquisition of basic mathematical skills and learning? and
3) What role should the National Institute of Education play in addressing these problems?

Volume II contains a description of the background and organization of the conference, reports of the small working groups on the topic of:
1) classroom instruction and teacher education;
2) curriculum development and implementation;
3) goals for basic mathematical skills and learning; and
4) research priorities;
and some summarizing remarks by the cochairmen of the conference (Peter Hilton and Gerald Rising).

Author:
National Institute of Education, and
National Science Foundation.

Accession Number:
M A 049

Title:
Report of the conference on needed research and development on hand-held calculators in school mathematics, June, 1976, 70 pp.

Availability:
Ed Esty
Basic Skills Group - National Institute of Education
Mail Stop 7 - 1200 19th Street, N.W.
Washington, D.C. 20208

Cost: No cost (Available in single copies only)

Abstract:

This booklet reports and discusses the recommendations of the conference on needed research and development on hand-held calculators, which was held in June, 1976. The participants of the conference were asked to "produce a planning document that will provide a well-defined framework for future research and development efforts. ...that NSF and NIE may use if they wish as a guide to program planning."

The recommendations include:

1) development of an information base from existing literature, observation of current instructional practices, surveys of the uses of ordinary calculation in everyday life, and long-term studies of the use of calculators as instructional instruments;
2) curriculum development of materials using calculators as teaching tools, teaching estimation, approximation, significant digits, etc., and development and testing of curriculum materials on new topics that the use of calculators make feasible;
3) long-range curriculum development of K-6 elementary school mathematics programs that incorporate the use of computers whenever appropriate;
4) research and evaluation to accompany and complement curriculum development;
5) teacher education to coincide with curriculum development and dissemination of research findings; and
6) dissemination efforts to communicate new information and recommendations to schools and teachers, especially at the elementary school level.

3/79:JV

Author:
Osborne, Alan (ed.)

Accession Number:
M A 0 8 6

Title:
An In-Service Handbook for Mathematics Education, Reston, VA, National Council of Teachers of Mathematics, 260 pp. 1977.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091

Cost: $6.20

Order No. 49

Abstract:
A collection of ten articles on in-service education of teachers, "organized around four purposes:

1. to examine the fundamental purposes and goals of in-service education;
2. to report the perceptions of teachers and supervisors about the what-is and what-ought-to-be of in-service education;
3. to discuss and analyze policies, processes, and procedures for in-service education in terms of the roles and responsibilities of individuals and institutions participating in the in-service effort; and
4. to consider the future of in-service education for mathematics teachers."

The handbook is an extension of the NCTM In-Service Project, is focussed from K through 12, and offers 92 references in its bibliography, the most recent of which is dated 1976.

3/79:JV

Author:
Payne, J.N. (Ed.)

Accession Number:
M A 0 4 3

Title:
Mathematics learning in early childhood (37th Yearbook). Reston, Va.: National Council of Teachers of Mathematics, 1975, 316 pp.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $16.90 (Prepay orders under $20)

Order No. 16

Abstract:
This book is designed for use as a resource book for teaching mathematics to children aged 3-8. It includes chapters on cognition, curriculum, research, and teaching procedures, as well as many ideas and activities for classroom instruction. The editors set forth a developmental point of view toward learning, with an emphasis on problem-solving and relating mathematics to the real world of the child.

3/79:JV

Author:
Payne, J.N.

Accession Number:
M A 0 1 9 C

Title:
Review of research on fractions. In R. A. Lesh and D. A. Bradbard (Eds.). Number and measurement: Papers from a research workshop. Athens, Georgia: University of Georgia, 1976. (ERIC/SMEAC Information Reference Center No. 240M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: HC $12.71
MF $ 0.83

Order No. 240M

Abstract:

This report reviews the research on fractions by studies done at Michigan between 1968 and 1975. Other research is also included as background for these studies. There are 32 references listed, including 18 dissertations.

This paper shows how the emphasis of the Michigan studies have shifted. At first, the studies compared "different algorithms, analyzing the strengths and weaknesses of each;" then, "they became more developmental." Currently "more attention is being given to the cognitive structures resulting from different combinations of rules and concrete models.

The author concludes by mentioning specific questions for needed research in the areas of: a number line model for fractions; a set model for fractions; relating $a \div b$ and a/b; equivalent fractions; addition and subtraction of fractions; the length of time it takes to teach fractions and operations with fractions to various students; and problem solving and applications with fractions.

Author:

Pikaart, Len, and Others.

Accession Number:

MA103

Title:

Bibliography of Research Studies in Elementary School and Pre-School Mathematics.
Athens, GA: Georgia University. 1966. 55 pp.

Availability:

ERIC Document Reproduction Service
P. O. Box 190
Arlington, VA 22210

Cost: MF $0.25
HC $2.85

Order No. ED 023 464

Abstract:

This bibliography is divided into seven sections. The first includes studies on students at various elementary levels, grouping procedures, practices and implications for teaching mathematics, and attitude improvement by effective teaching. Studies in the second section cover teacher training, attitudes, abilities, and level of achievement. Another section provides research information on textbooks, topics for programs, and program comparison (foreign and American). Within this section, feasibility studies on separate elementary levels and appropriateness studies are included. A fourth section deals with studies on different teaching methods at specific levels and in elementary school in general. Reports on instructional aids are included in this section. Studies on curriculum development are grouped along with those on the philosophy, history, and future of teaching mathematics. Evaluation literature is on the sixth section. A final section gives reviews of research and bibliographies. Most entries are dated in the late 1950s and early 1960s; some are listed more than once, but none are annotated.

3/79:JV

Author:
Pikaart, L. & Wilson, J.W.

Accession Number:
M A 0 0 1 A

Title:
The research literature. In National Council of Teachers of Mathematics, The slow learner (thirty-fifth yearbook). Reston, Virginia: National Council of Teachers of Mathematics, 1972, 528 pp.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $16.90

Order No.: 14

Abstract:

This chapter reviews the research concerned with teaching of mathematics to slow learners and suggests avenues of research that appear productive. The chapter's major sections consider the identification of slow learners, concomitant variables of slow learning, research in instructional programs, and studies that are predictive of future trends. The most recent of the 174 references cited is dated 1971.

The authors find the research on the slow learner in mathematics very limited. Concerning slow learners in general, the authors discuss the misuse of I.Q. scores as placement criteria for class typing students. Emphasized instead is the concept of an instructional program based on mastery learning.

Author:
Riedesel, C.A.

Accession Number:
M A 0 4 5

Title:
Research suggestions: Use of Time in teaching elementary school mathematics.
The Arithmetic Teacher 18:177-179, 1971.

Availability:
NCTM
1906 Association Drive
Reston, VA 22091

Cost: $2.50

Abstract:

This article reports the answers suggested by research to questions concerning how teaching time should be used in elementary school mathematics instruction. Topics discussed include: the length of the class period, developmental and drill activities, homework, and retention. A list of 22 references is included; the most recent article is dated 1968.

Research suggestions include:
1) an increased amount of mathematics instruction time should result in significant increase in achievement;
2) students who spend most of their mathematics instruction time on developmental activities are better in computation than those who spend most of their time practicing computation;
3) homework in elementary school mathematics has not been shown to improve achievement or attitude, but some research indicates that it may aid in immediate increase in computational skills; and
4) retention can be facilitated by making mathematics instruction meaningful to the students, adjusting the learning tasks to the appropriate achievement and intellectual level of the child, using intensive review procedures, periodically retesting old material, allowing students to diagnose their own mistakes, and using guided discovery teaching approaches.

Author:
Riedesel, C.A., and Pikaart, L.

Accession Number:
M A 0 4 6

Title:
Recent research contributions to elementary school mathematics. The Arithmetic Teacher 17:245-252, 1970.

Availability:
NCTM
1906 Association Drive
Reston, VA 22097

Cost: $2.50

Abstract:

This article surveys significant research in elementary school mathematics from World War II to the present time (1970) covering approaches to content, approaches to teaching, and materials. The extensive bibliography lists 117 Journal articles and dissertations.

Some of the research findings presented include:

1) many beginning kindergarten children recognize and understand counting of rational numbers beyond 10, sets of 1, 2, 3, or 4 objects, several comparative terms (i.e., largest, smallest), the calendar, foot rule and quarts, telling time to the hour, the circle and the square, the solution of simple verbal problems, and objects cut into halves or thirds; however, previous school experience, socioeconomic background and sex cause wide differences among individual children;
2) some of the traits found in "good" problem-solvers are intelligence, computational ability, ability to estimate answers, ability to analyze problems, knowledge of mathematical vocabulary, ability to use quantitative relations, ability to note irrelevant detail, and knowledge of mathematical concepts;
3) the "meaning method" of teaching mathematics facilitates retention, transfer, greater understanding of mathematical principles, and comprehension of complex analysis;
4) maximum achievement in elementary school mathematics is obtained when over half of the instruction time is given to developmental teaching rather than practice.

3/79:JV

Author:
Robinson, M.L.

Accession Number:
M A 0 5 8

Title:
Attitudes and achievement: A complex relationship. 1975 (ERIC Document Reproduction Service No. ED 111678)

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: MF $0.83

Order No. ED 111678

Abstract:
This paper investigates the popular belief that children's attitudes toward school and particular subjects have a positive relationship with their school and subject achievement. Empirical studies which examine the correlations between attitude and achievement are discussed. The list of references includes thirteen journal articles and books; the most recent citation dated 1970.

The paper proposes that it is probable that an observed relationship between attitude and achievement does not necessarily exist. The paper concludes with the implications of the last statement for educators. These implications include the need to study more carefully the reasons why attitude is not a strong correlate of achievement. A second implication is that educators should not be too hasty nor too sure in making assessments of attitudes from students' expressed opinions or overt behavior.

Author: **Accession Number:**

Romberg, T.A. M A 0 0 8

Title:

Current research in mathematics education. Review of Educational Research, 1969, 39, 473-491.

Availability: **Cost:** ($13.00 annually)

American Educational Research Association
1126 16th St. N.W.
Washington, D.C. 20036 (quarterly)

Abstract:

Author reviews the quality of research in mathematics education, the directions taken by the research between 1964-69, and the trends likely to occur.

Using 97 references, the author categorizes the research into eight areas:
1) mathematical learning from an association learning framework;
2) mathematical learning from an activity learning framework;
3) mathematical problem solving and creative behavior;
4) mathematics teaching;
5) the effectiveness of instructional programs;
6) the association of learner characteristics with mathematical achievement;
7) attitudes toward mathematics; and
8) the evaluation and measurement of mathematics achievement.

Current research is characterized as large in quantity (over a thousand studies during the five year period reviewed), diverse, and poor but improving in quality. Poor quality of most research is attributed to too much interest in mathematical components and too little concern for experimental design, measurement or analysis.

Apparent trends in research include development of improved tests for use in mathematics education, more and better basic research, improved curriculum evaluation, and greater support for conducting long-term research in connection with continuing programs in mathematics.

Author:
Rosskopf, M.F., Steffe, L.P., & Taback, S. (Eds.).

Accession Number:
M A 0 0 2

Title:
Piagetian cognitive-development research and mathematics education. Reston, Va.: National Council of Teachers of Mathematics, 1971, 243 pp.

Availability:

Cost: $6.75

National Council of Teachers of Mathematics
1906 Association Drive
Reston, Va. 22091

Order No. 73

Abstract:

This book presents proceedings of a conference held in 1970 to examine the scope of Piagetian research in mathematical education. Articles summarizing research are abstracted in accession numbers MA002A and MA002B.

Author:
Schoen, H.L.

Accession Number:
M A 0 4 2

Title:
Implications of research for instruction in self-paced mathematics classrooms. In F. J. Crosswhite & R. E. Reys (Eds.), Organizing for mathematics Instruction (1977 Yearbook). Reston, Va. : National Council of Teachers of Mathematics.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $11.25

Order No. 18

Abstract:

This article reviews more than 100 studies, mostly unpublished, dealing with self-paced mathematics instruction (SPI). The most recent reference is 1976. The author considers the empirical evidence dealing with the question, "Does SPI have educational benefits, and do they outweigh any liabilities?"

Research evidence has failed to demonstrate consistently a superiority of SPI over traditional instruction on achievement or affective variables; SPI appeared to be as effective as traditional instruction with self-motivated, high-ability students and those with special learning problems. Use of supplementary teaching materials and multi-media options have increased the effectiveness of SPI; and the diagnostic-prescription aspect of SPI has not been shown to be effective.

3/79:JV

Author:
Schoen, Harold L.

Accession Number:
M A 1 0 4

Title:
Individualized Mathematics Instruction: What are the Specific Problems?
University of Iowa, 1976. 25 pp.

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, VA 22210

Cost: MF $0.83
HC $1.67 + postage

Order No. ED 137 102

Descriptors:
Achievement; Curriculum; Individualized Instruction; Instruction; Mathematics Education; Elementary School Mathematics; Elementary Secondary Education; Secondary School Mathematics; Research Reviews (Publications);

Abstract:

Research dealing with specific aspects of individualized mathematics programs is summarized in this paper. Some explanations for the failure of self-pacing to result in superior achievement are examined. Studies dealing with student-teacher interaction in individualized programs are cited. Research with implications for the new directions for individualization is reviewed. Finally, characteristics of successful students in self-paced programs are examined along with some alternate approaches to individualization.

3/79:JV

Author:
Schoen, H.L.

Accession Number:
M A 0 3 4

Title:
Self-paced mathematics instruction: How effective has it been? The Arithmetic Teacher, 23:90-96, 1976.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Va. 22091

Cost: $2.50

Abstract:

Thirty-six studies, in which elementary school children in a self-paced mathematics program were compared to traditionally taught children using arithmetic achievement and various affective measures as the criteria for comparison, are discussed. Thirty-three references are cited including nineteen dissertations. The most recent citation is dated 1976.

Major findings in arithmetic achievement appear to be ambiguous at the K-4 grade levels but the results in grades 5-8 very definitely favor the nonindividualized or traditional teaching approaches. With regard to the affective measures, the self-paced programs appear superior in the primary grades but not with grades 5-8. Other findings are:
1) high ability students usually do as well in a self-paced program as in any other, but average and below average students are likely to achieve less in these programs;
2) there is no consistent difference between boys and girls achievements or attitudes in self-paced programs;
3) diagnostic techniques used in self-paced programs have not been effective; and
4) attempts to fit students to self-paced or teacher-centered instructional approaches based on personality characteristics and learning styles have been unsuccessful.

The author feels that although concern for the individual student's needs is important, the self-paced approaches should not be blindly adopted without consideration of additional expense, additional teacher time and energy and the apparent ineffectiveness of many such programs.

Author:
Schoen, H.L. and Drapac, G.L.

Accession Number:
MA053

Title:
An annotated bibliography of research on self-paced mathematics instruction (1965-1976). Iowa City, Iowa, 1976 (ERIC Document Reproduction Service No. ED 128204)

Availability:
ERIC Document Reproduction Service
P.O. Box 190
Reston, Virginia 22210

Cost: M F $0.83

Order No. ED 128204

Abstract:

This bibliography provides information and brief annotations for 148 papers reporting research into the effectiveness of self-paced instruction in mathematics. The citations are organized into three major categories:

1) research summaries (8 papers);
2) studies comparing the effectiveness of self-paced programs with that of more traditional programs (101 papers); and
3) studies designed to analyze or evaluate specific components of self-paced programs (39 papers).

The papers annotated deal with mathematics instruction at all levels from primary grades through college, and with a variety of cognitive and affective criteria for judging the effectiveness of instruction.

Author: School Mathematic Study Group (SMSG)

Accession Number:
M A 0 5 7

Title:
Test factors, instructional programs, and socio-cultural-economic factors related to mathematics achievement of Chicano students: A review of the literature. SMESG Working Paper No. 10. Stanford, California: Stanford University School Mathematics Study Group, 1975. (ERIC Document Reproduction Service No. ED 11 198)

Availability:
ERIC Document Reproduction Service
P. O.Box 190
Arlington, Virginia 22210

Cost: $2.06 HC
$0.83 MF

Order No.: ED 113198

Abstract:

The purpose of this paper is to identify patterns of performance which might yield insight into findings concerning mathematics achievement of Chicano students. The Chicano student populations of these studies were identified and restricted by the following criteria: Spanish surname, of Mexican descent, language (bilingual, Spanish-English; monolingual, Spanish), geographic area (southwestern and western United States). The majority of Chicano students in the studies were from backgrounds of low socioeconomic status. This paper summarizes the general results of the literature reviewed and concludes with an annotated bibliography (41 citations). The list of references includes four sources.

"The research suggests that tests and instruments that are developed for the Anglo population might have serious reliability and predictability problems when administered to the Chicano students. The results must be interpreted with great care."

The authors suggest a need for research in the areas of:
1) using tests developed for the Anglo population with Chicano students;
2) the effect of bilingual programs on the mathematics achievement of Chicano students; and
3) the need to incorporate socio-cultural-economic information in research on the school performance of Chicano students.

Author:
Shafer, B.

Accession Number:
M A 078 A

Title:

Interference, facilitation, and comparisons. In M. N. Suydam and A. R. Osborne (Eds.), Algorithmic learning. Columbus, Ohio: Ohio State University, 1975. (ERIC, Science, Mathematics and Environmental Education Clearinghouse No. 237 M)

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $3.75

Order No. 237 M

Abstract:

This paper deals with factors that may interfere or facilitate the learning of various algorithms. It also discusses the effects of presenting two alternative algorithms. Twenty-three references are cited; the most recent dated 1971.

The author notes that most studies comparing two alternative algorithms involve teaching only one algorithm to each of two groups. This eliminates the opportunity to study retroactive/proactive interference. The author concludes by citing the conclusions of several researchers who successfully combined two algorithms; however, two other researchers recommended the use of two methods even though their studies did not actually do so.

3/79:JV

Author:
Sherman, J.

Accession Number:
M A 0 7 9

Title:
Effects of biological factors on sex-related differences in mathematics achievement. Madison, Wisc: Woman's Research Institute of Wisconsin, Inc., 1977. (NIE Contract No. 400-76-0113).

Availability:
Correspondence to author:
Julia Sherman
3917 Plymouth Circle
Madison, WI 53705

Abstract:

This paper presents a critical review of the literature relevant to the effects of biological factors on sex-related differences in mathematics performance, with recommendations for further research. The reference list includes 162 citations; the most recent ones are dated 1976.

Empirical support for the hypotheses regarding the effect of biological performance on sex-related differences in math is weak and most were inconsistent with available data. "Some tentative support was found for the role of earlier left cerebral dominance in females as a factor, interacting with educational and cultural experiences, which could lead more females than males to emphasize a verbal, analytic rather than a spatial, gestalt approach."

The author feels the greatest research need is "for broad-based, programatic, developmental research which can provide the knowledge base for maximal development of cognitive functioning in the female sex."

Author:

Steffe, L. (ed.).

Accession Number:

M A 0 0 5

Title:

Research on mathematical thinking of young children: Six empirical studies.
Reston, Va: National Council of Teachers of Mathematics, 1975, 208 pp.

Availability:

National Council of Teachers of Mathematics, Inc.
1906 Association Drive
Reston, Virginia 22091

Cost: $6.00

Order No. 84

Abstract:

This monograph presents six research papers designed to investigate the mathematical thinking of children between four (4) and eight (8) years of age. Five of the six papers deal with aspects of training and acquisition of logical structures and the sixth with the acquisition of structures involved in conservation and measurement. Two other papers -- one developing a model for learning and teaching mathematics and the other summarizing the six research papers -- are also included. Cited are 149 references the most recent of which is dated 1974.

Based on the five studies investigating training programs, the author of the research summary paper concludes that suitable teaching programs aimed at improving children's understanding of certain mathematical ideas such as equivalence relations ("same length as"), order relations ("longer than"), and transitivity relations can profitably be undertaken with Kindergarten, Grade 1, and Grade 2 children providing such children are not slow learners and do not come from disadvantaged homes. The one study reported among disadvantaged children suggests that teachers must not be disappointed when there is improvement in performance only on tasks very close to those that have been taught.

Ideas for specific research efforts within the framework of Piagetian Theory are presented.

Author:
Steffe, L.P., and Hirstein, J.J.

Accession Number:
M A 0 5 2

Title:
Children's thinking in measurement situations. In D. Nelson and R. E. Reys (eds), *Measurement in school mathematics* (1976 yearbook). Reston Virginia: National Council of Teachers of Mathematics, 1976. 256 pp.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $11.25(prepay orders under $20)

Order No. 17

Abstract:

This chapter discusses how children think in measurement situations (i.e., length, area, and volume, weight and time). The authors tend to emphasize the importance of cognitive development and rely heavily on the findings of Piaget and his associates. The list of references includes 24 articles and books; the most recent citation is dated 1975.

The authors suggest that children's thinking in measurement situations is determined by several factors and their thinking may vary as these factors are changed or altered. These factors are:
1) cognitive and affective aspects of the individual;
2) social aspects;
3) mathematical content to be taught; and
4) methods of presenting mathematical content.

Author:
Suydam, M.

Accession Number:
M A 0 8 2

Title:
Evaluation in the Mathematics Classroom: From What and Why to How and Where. Columbus, Ohio; Ohio State University, 1974 (ERIC Clearinghouse) 64 pages.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091

Cost: $2.60

Order No.: 105

Abstract:

This document "is intended more as a quick reference guide than as an encyclopedia on the topic of evaluation of mathematics instruction." It focusses on instruction evaluation and leaves aside the issues of teacher evaluation of textbooks, materials, and programs. One hundred and fifty annotated references are cited; the most recent is dated 1974.

The author feels that the research indicates that evaluation can, and should, be much more than paper-and-pencil tests.

The author presents comments on various types of evaluation techniques and presents suggestions for the development of such tests.

3/79:JV

Author:

Suydam, M.N.

Accession Number:

M A 0 6 9

Title:

Interpretive study of research and development in elementary school mathematics: Phase 2. Final Report, University Park, Pennsylvania: Pennsylvania State University, August, 1970, 179 pp. (ERIC Document Reproduction Service No. ED 043508)

Availability:

ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: $9.95 HC
$0.83 MF

Order No. ED 043508

Abstract:

The Interpretive Study of Research and Development in Elementary School Mathematics was designed to attack the problem of applying research in the classroom by providing a compilation of the research and a synthesis of the findings. The purpose of Phase II of the study was to develop materials which could be readily used and disseminated. A set of eleven bulletins and a set of five films were developed for use by college teachers of courses on the teaching of elementary school mathematics. This report concentrates on the development, dissemination, and evaluation of these bulletins and films. One conclusion drawn from the reactions of those receiving the developed materials is that there is a continuing need to provide a readable, readily available source of information on research related to teaching and learning elementary school mathematics.

NOTE: The set of eleven bulletins were revised in 1975. Ten related abstracts in Suydam, M. and Weaver, J.F., Using Research: a key to elementary school mathematics, are contained in this bibliography.

Author:

Suydam, M.N.

Accession Number:

M A 0 2 2

Title:

Teaching mathematics to disadvantaged pupils: A summary of research. Columbus, Ohio: ERIC Information Analysis Center for Science and Mathematics Education, 1971. (ERIC Document Reproduction Service No. ED 049 934)

Availability:

ERIC/SMEAC Information Reference Center.
The Ohio State University, College of Education
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $1.60 (offset with cover)

Order No. 201M

Abstract:

This paper reviews research related to teaching mathematics to disadvantaged students. Accompanying the paper is an annotated bibliography of nearly 300 research references divided into categories of environmentally disadvantaged and academically disadvantaged (low achievers, remediation, slow learners, and mentally retarded).

Implications drawn from the research with disadvantaged students include:
1) disadvantaged students profit from special attention in the form of attention from the teacher, the content of the program, the instructional materials, or the organization of instruction;
2) rate of learning must be consistent in adapting methods and materials for slower learners;
3) active physical involvement with manipulative materials may be very important for the disadvantaged;
4) while there is some evidence that "discovery" approaches are not as effective as "rule" approaches, the degree of mathematical meaning which is optimal for disadvantaged students is unknown; and
5) pupils who are disadvantaged mathematically may also be disadvantaged on other factors related to their mathematical learning (for example, reading ability).

The author states that research on disadvantaged learners suffers from several limitations:
1) choice of words used to describe the disadvantaged learner is often unclear;
2) sampling procedures, control of variables, and design are frequently questionable; and
3) the work of practitioners who have developed and tried out programs for various groups of disadvantaged is not easily available.

Author:
Suydam, M.N.

Accession Number:
M A 0 0 7 A

Title:
The status of research on elementary school mathematics, In R. B. Ashlock W. L. Herman, Jr. (eds.). Current Research in Elementary School Mathematics.

Availability:
The Macmillan Publishing Company
866 Third Avenue
New York, NY 10022

Cost: $7.25 paper

Abstract:
This article reviews the research on elementary school mathematics reported in Journals from 1900-1965. Questions of interest are:
1.) How much research has been published?
2.) What types of research have been published?
3.) What topics have been included in these published reports?
4.) How useful is research to classroom needs?

The author found a total of 799 research reports in 50 Journals. Together, surveys and experimental research accounted for nearly 90% of studies.

Ordered by frequency, the topics of research are problem solving, achievement evaluations, planning and organizing for teaching, textbooks, diagnosis, remediation, content to be included in grades, testing drill and practice, measurement, and division of whole numbers. In discussing the specific help provided by research studies for classroom teachers, the author states, "There is no clear and well defined pattern of evidence from journal published research. The knowledge of the educator must be used to supplement the findings."

2/79:JV

Author: Suydam, M.N., and Dessart, D.J.	Accession Number: M A 0 1 3

Title:
Classroom ideas from research on computational skills. Reston, Va.: The National Council of Teachers of Mathematics, Inc., 1976, 64 pp.

Availability:	Cost: $3.40
National Council of Teachers of Mathematics, Inc.	
1906 Association Drive	
Reston, Virginia 22091	Order No.: 26

Abstract:

This booklet presents non-technical descriptions of selected research findings on computation learning and how elementary school teachers might use them. One hundred and sixty-one references are cited, including 58 dissertations. The most recent citation is dated 1975.

The booklet summarizes research results on computational skills with whole and rational numbers under five categories-introducing, reinforcing, maintaining, transferring, and applying. Some of the findings include:

1) mathematical ideas and skills should be developed from a concrete physical base;
2) the understanding of each type of mathematical operation should precede repetitive drill to memorize the basic facts;
3) more emphasis should be placed on helping children to solve different forms of number sentences;
4) maintaining computational skills involves practice and review to make the mastery firm;
5) meaningful instruction which emphasizes generalizations and relationships, as well as discovery-oriented instruction facilitates transfer; and
6) providing children with a wide variety of opportunities to solve problems of all types and all levels of difficulty, is essential in helping them to apply computational skills.

3/79:J
V

Author:
Suydam, M.N., and Higgins, J.L.

Accession Number:
M A 0 8 1

Title:
Activity-based learning in elementary school mathematics: Recommendations for research. Columbus, Ohio: The Ohio State University, 1977. (Will be available from the ERIC Document Reproduction Service). 180 pp.

Availability:
ERIC Document Reproduction Service
P.O. Box 190
Arlington, Virginia 22210

Cost: $3.50 offset, perfect bound.

Order No. 253 M

Abstract:

This report reviews and synthesizes studies of "activity-based" approaches to mathematics teaching. This synthesis was restricted to studies in which the mathematical content did not go beyond what is commonly found in grades K-8 and it included only studies dealing with elementary school children, especially low-achievers.

Some of the conclusions from this review and synthesis are:
1) there is a higher probability of producing greater mathematical achievement when lessons include the use of manipulative materials;
2) the use of symbolic sequences is not as effective as the use of manipulative materials;
3) research results indicate no difference in achievement whether one or several embodiments of mathematical ideas are presented;
4) research indicates that it is as effective for children to watch the teacher demonstrate with materials as it is for them to use materials themselves;
5) the use of materials appears to be effective with children at all achievement, ability and socio-economic levels, and is of some value for all grade/age levels in elementary school;
6) the use of materials appears to be effective for addition-subtraction, multiplication fractions, and problem solving;
7) mathematics laboratories can produce at least equivalent achievement and attitudes as traditional approaches; and
8) students using activity-oriented programs can be expected to achieve as well or better than students using programs not emphasizing activities.

3/79:JV

Author:
Suydam, M.N., and Osborne, A.R. (Eds.)

Accession Number:
M A 0 7 8

Title:
Algorithmic learning. Columbus, Ohio: Ohio State University, 1975.
(ERIC Science, Mathematics and Environmental Education Clearinghouse No. 237 M)

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: $3.75

Order No. 237 M

Abstract:

This volume contains a series of papers on algorithmic learning. Included are six reviews of research pertaining to various aspects of algorithmic learning, six reports of pilot experiments in this area, a theoretical discussion of "The Conditions for Algorithmic Imagination," and an annotated bibliography. All the papers assume a common definition of algorithmic learning as "the process of developing and/or applying methods or procedures, i.e., algorithms, with the goal of learning-how-to-learn." A common definition of algorithm is also used. Topics covered by literature reviews include algorithmic processes for cognition, algorithms and hierarchies, conceptual bases for the learning of algorithms, interference with the learning of algorithms, algorithmic problem solving, and algorithms and mental computations. Research papers report on studies related to algebra (3), arithmetic (2) and the use of desk calculators (1). The authors conclude that there are many open researchable questions in the area of algorithmic learning.

For summaries of articles dealing with research findings, see the entries in this bibliography under B. Shafer and R. Zepp.

Author:

Suydam, Marilyn N. and Osborne, Alan.

Accession Number:

M A 0 9 7

Title:

The Status of Pre-College Science, Mathematics, and Social Science Education: 1955-1975. Vol. II. Mathematics Education. Columbus, Ohio: Ohio State University, 1977. 289 pp.

Availability:

Abstract:

This historical study provides evidence on the status of mathematics education during a twenty-year period, with the intent to ascertain causes and effects of educational policy formation. Literature of the period is analyzed to determine what were the existing practices in mathematics education and whether or not information about those practices was used in decision-making concerning policy in education. Five hundred thirty-two annotated references are cited; the most recent is dated 1977. Three major themes are treated: the schools, the teachers, and needs assessments (planning documents and assessment results at national and state levels).

The authors conclude that progress and change in mathematics education have resulted from federal intervention even though there has not been systematic information collection about existing practices. This progress apparently has occurred, the authors conclude, because the societal/political ethos has provided substantial direction.

3/79:JV

Author:
Suydam, M.N. and R.E. Reys (Eds.)

Accession Number:
M A 0 8 3

Title:
Developing Computational Skills, NCTM 1978 Yearbook, Reston, VA;
National Council of Teachers of Mathematics 1978; 256 pp.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $12.00

Order No. 19

Abstract:

A collection of 14 articles on a broad spectrum of computational topics, such as practice activities, computational skills with a calculator, addition/subtraction algorithms, estimation, and other. The articles deal mainly with the elementary level, with some activity suggestions for junior high.

3/79:JV

Author:
Suydam, M.N. and Weaver, J.F.

Accession Number:
M A 0 1 5 F

Title:
Addition and subtraction with whole numbers. In Using research: A Key to elementary school mathematics (Rev. ed.) Columbus, Ohio: The Ohio State University, 1975 (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238M

Abstract:

This bulletin summarizes research findings on addition and subtraction with whole numbers in elementary school mathematics instruction. The selected list of references includes 52 articles, with the most recent citation dated 1975.

Research suggests that:
1) the teacher must assess each student individually because not all children have the counting skills or other skills necessary to begin work with addition and subtraction;
2) subtraction is harder for children to learn than addition;
3) drill per se is not effective in developing mathematical concepts;
4) having students check their work may contribute to greater accuracy if students understand the purpose of checking their answers and how to correct their mistakes;
5) teachers should be careful of the order in which they introduce different types of open number sentences because some are more difficult for children to solve (e.g. open subtraction sentences are more difficult to solve than open addition sentences); and
6) understanding is best facilitated when concrete materials are presented first followed by semi-concrete materials (i.e. pictures) and finally, by abstract presentations (i.e. numerals, symbols and/or words); however, it is unclear how important it is that every child should proceed through all three of these phases.

Author:
Suydam, M.N. and Weaver, J.F.

Accession Number:
M A 0 1 5 A

Title:
Attitudes and interests. In Using research: A key to elementary school mathematics. (Rev. ed.) Columbus, Ohio: The Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Rd., 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238 M

Abstract:

This bulletin presents a summary of research findings regarding the affective factors of attitudes and interests of elementary and secondary school students toward mathematics. The list of selected references consists of 37 articles, including 14 dissertations; the most recent citation is dated 1975.

Research findings suggest:
1) by the time they are in the intermediate grades students have developed a relatively definite attitude toward mathematics;
2) generally as students progress through school their attitudes toward mathematics become increasingly less positive;
3) there is no consistent body of research evidence to support the belief that there is a significant positive relationship between pupil attitudes toward mathematics and pupil achievement in mathematics; and
4) there is some evidence to support the view that the teacher is the prime determiner of a student's attitude and performance.

The authors suggest that student attitude and interest toward mathematics may be improved if:
1) the teacher likes mathematics and the students are aware of the teacher's attitude;
2) mathematics is made enjoyable for students;
3) mathematics is shown to be useful to the student in everyday activities;
4) mathematics instruction is made relevant to student interests;
5) mathematics is shown to be understandable; and
6) students are provided with short-term, achievable goals so that they can experience success or receive immediate remedial help for failure.

3/79:JV

Author:
Suydam, M.N. and Weaver, J.F.

Accession Number:
M A 0 1 5 D

Title:
Differentiating instruction. In *Using research: A key to elementary school mathematics* (Rev. ed.). Columbus, Ohio: The Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238M

Abstract:

This bulletin summarizes research findings relating to attempts to organize mathematics programs and instruction in relation to the unique needs and abilities of individual children. The selected list of references cites 54 articles, including 20 dissertations. The most recent article is dated 1976 (in press).

The general research consensus is that no *one* plan for differentiating instruction is best. The authors suggest that the teacher should consider the factors related to pupil's achievement and interest in mathematics, as well as the school's organization methods, in order to decide on the appropriate variations in content, material, method, and time. Some more specific research findings include:

1) age and intelligence are highly related to ability to learn various specific mathematical ideas;
2) children from low socioeconomic groups have less mathematical background when they enter school than children from middle socioeconomic groups;
3) evidence on the effectiveness of grouping for mathematics instruction is conflicting, partly because grouping can be done on the basis of ability or achievement; and
4) there is *no* evidence to show that the special provisions for instructional organization in either IPI (Individually Prescribed Instruction) or in PLAN (Program for Learning in Accordance with Needs) help to improve achievement in mathematics.

Author:

Suydam, M.N. and Weaver, J.F.

Accession Number:

M A 0 1 5 I

Title:

Geometry and other mathematical topics. In Using research: A key to elementary school mathematics (Rev. ed.) Columbus, Ohio. The Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238M

Abstract:

This bulletin cites research findings regarding the content areas of geometry, measurement, graphing, the numeration system, integers, sets, probability and statistics and logic in elementary school mathematics. The selected list of references cites 66 articles, including 41 dissertations. The most recent citation is dated 1975.

A consensus of opinion regarding research findings is not presented for any of the topics discussed. Instead, research findings from selected individual studies are presented.

Some findings include:
1) there is evidence that children can learn many geometric ideas associated with plane figures;
2) students' amount of familiarity with measurement ideas vary widely according to age, socioeconomic level and mental ability;
3) there is some evidence that learning about other bases increases understanding of the decimal numeration system; however, emphasizing the structure and properties of the decimal system seems just as effective;
4) there is limited research evidence on the effect of teaching properties and relations, but this may facilitate other mathematical learning;
5) there is little research evidence on teaching the topic of integers, but concrete and abstract approaches may be effective;
6) ideas about sets appear to be useful in introducing both numerical and geometric concepts;
7) intermediate grade children have acquired considerable familiarity with probability from every day experiences;
8) the simple statistics of mode, mean, and possibly the median can be introduced as early as grade 4; and
9) children aged 6-8 may be able to recognize valid conclusions derived from sets of given premises, but they may have difficulty testing the logical necessity of a conclusion.

3/79:JV

Author:
Suydam, M.N. and Weaver, J.F.

Accession Number:
M A C 1 5 E

Title:
Instructional materials and media. In Using research: A Key to Elementary School mathematics (Rev. ed.). Columbus, Ohio: The Ohio State University, 1975 (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238M

Abstract:

This bulletin presents results from various studies analyzing instructional materials and the effectiveness of the use of these instructional materials and media in elementary school mathematics instruction. The list of selected references contains 48 articles, including 26 dissertations. The most recent citation is dated 1975.

The authors discuss research findings relating to the analyses of mathematics textbooks, the usefulness of mathematics tests, the vocabulary level of mathematics textbooks, the use of programmed instruction, the role of manipulative materials, and the use of computers and calculators in mathematics instruction. There is little or no consensus of opinion on the research findings discussed in any of these areas. Instead, various topics in each area are discussed. A few specific findings suggest:

1) mathematics teachers should consider the vocabulary level of the textbooks they use;
2) the use of programmed materials may result in a decrease in the time which most students must spend on a topic;
3) programmed materials are most effective when they are used to assist the teacher in spending more time working with individual students, and
4) both computers and hand-held calculators appear to be facilitative in mathematics instruction; however, more research needs to be done to determine when and how handheld calculators can be most effectively used, as well as determining the long-ranged impact of their uses.

Author:

Suydam, M.N., and Weaver, J.F.

Accession Number:

M A 0 6 6

Title:

Mathematics and the "disadvantaged." In Using research: A key to elementary school mathematics. Columbus, Ohio: ERIC Information Analysis Center for Science Education, 1971. (ERIC Document Reproduction Service No. ED 051 001)

Availability:

ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: $1.67 HC
$0.83 MF

Order No. ED 051 001

Abstract:

This bulletin provides a review of research related to teaching mathematics to disadvantaged students at the elementary school level. The selected list of references cites 32 journal articles including 12 dissertations. The most recent citation is dated 1970.

A summary of conclusions based on the research discussed includes:

1) the disadvantaged, like other pupils, profit from special attention;
2) disadvantaged and advantaged pupils have similar skills and abilities, but differ in depth or level of attainment;
3) rate of learning, methods and materials of instruction must be adapted for disadvantaged pupils;
4) active physical involvement with manipulative materials is especially important for the disadvantaged;
5) pupils who are disadvantaged in mathematics may also be disadvantaged in other factors related to mathematics learning such as reading ability, and this must be considered in developing the curriculum for the disadvantaged child;
6) more research and more evidence on "ideas which work" with disadvantaged students is needed; and
7) there is much need to individualize instruction for disadvantaged students, because they are not all disadvantaged in the same way. (Resources in Education/Author/K.G.)

Author:
Suydam, M.N. and Weaver J.F.

Accession Number:
M A 0 1 5 G

Title:
Multiplication and division with whole numbers. In Using Research: A key to elementary school mathematics (Rev. ed.). Columbus, Ohio: The Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No.: 238M

Abstract:

This bulletin cites research findings regarding the content areas of multiplication and division with whole numbers in elementary school mathematics. The list of selected references contains 31 articles and dissertations, the most recent citation is dated 1976 (in press).

Research suggests that activities and experiences which add to students' understanding of multiplication should precede rote memorization of facts. Research on the effectiveness of various algorithms for both multiplication and division indicate that some methods are effective with certain students while other algorithims are more effective with other students.

The bulletin cites selected research findings from individual studies on the topics of: 1) how multiplication should be conceptualized for children; 2) the distributive property in early work with multiplication; 3) the difficulty levels of multiplication combinations and division combinations; 4) the subtractive versus the distributive form of the division algorithm; 5) teaching pupils to estimate quotient digits; and 6) the role of measurement and partition situations in teaching division.

3/79:JV

Author:
Suydam, M.N. and Weaver, J.F.

Accession Number:
M A 0 1 5 B

Title:
Organizing for instruction. In Using research: A key to elementary school mathematics (Rev. ed.) Columbus, Ohio: The Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Rd., 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238 M

Abstract:

This bulletin cites research findings on ways of organizing the classroom for mathematics instruction in elementary school. There are 38 articles listed in the selected references, including 18 dissertations; the most recent citation is dated 1973.

The major research findings indicate:

1) that no one way of organizing for mathematics instruction is better than any other, in terms of increasing student achievement in mathematics;
2) research findings are equivocal regarding the importance of early or pre-first-grade mathematics instruction;
3) making mathematics instruction meaningful to students generally leads to greater retention, greater transfer and increased ability to solve independently; and
4) research has not conclusively indicated that the laboratory approach to mathematics is superior to any other approach.

3/79:JV

Author:
Suydam, M.N. and Weaver, J.F.

Accession Number:
M A 0 1 5 C

Title:
Promoting effective instruction. In Using research: A key to elementary school mathematics. (Rev. ed.). Columbus, Ohio: The Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Rd. - 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238 M

Abstract:

This bulletin presents a summary of selected research findings that provide specific suggestions for promoting effective instruction of elementary school mathematics. Thirty-nine articles, including 18 dissertations are included in the list of selected references. The most recent citation is dated 1975.

Research indicates:
1) the learner acquires understanding progressively in stages;
2) teacher enthusiasm and attitude as well as praise given to students tend to motivate or increase pupils interest and achievement in mathematics;
3) that children should be taught how to transfer or apply what they learn to other situations;
4) meaningful instruction and discovery oriented instruction tend to facilitate transfer of learning;
5) when mathematics instruction is meaningful to students and understood by them children will be more likely to retain the information;
6) review facilitates retention;
7) learning can be reinforced by providing students with immediate reinforcement (i.e. scores or correct answers), by the use of token reinforcements, or by the Teacher's use of verbal praise, physical contact and facial expression;
8) the research findings on the effectiveness of homework in increasing achievement or retention is equivocal;
9) teaching mental computation skills tends to increase arithmetic achievement and
10) the use of pupil-tutors may be effective in providing remedial help to increase student's computation skills.

3/79:JV

Author:

Suydam, M.N. and Weaver, J.F.

Accession Number:

MA015 H

Title:

Rational numbers: Fractions and decimals In Using research: A key to elementary school mathematics (Rev. ed.) Columbus, Ohio. The Ohio State University, 1975 (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No.: 238M

Abstract:

This bulletin cites research findings regarding the content areas of fractions and decimals in elementary school mathematics. The list of selected references contains 40 articles, including 17 dissertations. The most recent citation is dated 1975.

Some of the research findings presented include:

1) use of manipulative materials is important in developing a systematic program for presenting fractional ideas, and such a program seems essential in preparing children to work with symbols;
2) there is little evidence on the effectiveness of procedures for finding the common denominator in addition with fractions, and even less for subtraction with fractions;and
3) the major errors children make for all operations with fractions seem to be caused by difficulty with "reading", lack of comprehension of the operation involved and computational errors.

The authors suggest that, with the increased use of the metric system and hand-held calculators, it is important that decimals should be taught much earlier in elementary school and perhaps should be introduced before fractions.

3/79:JV

Author:
Suydam, M.N., and Weaver, J.F.

Accession Number:
M A 0 4 3 A

Title:
Research on mathematics learning. In J. N. Payne (ed.), Mathematics Learning in Early Childhood (37th Yearbook), Reston, VA: National Council of Teachers of Mathematics, 1975.

Availability:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Cost: $16.90 (Prepay orders under $20)

Abstract:

This chapter emphasizes research done on the learning of mathematics in school settings through grade 3. The authors review studies in the affective area; but major emphasis is on the learning of mathematical ideas and skills. The reference list includes 120 citations. The most recent citation is dated 1972.

The authors report that little research has been done concerning the attitudes of young children toward mathematics. The consensus of opinion among teachers and other mathematics educators is that "children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics."

Among the research reported:

1) mathematical achievement may be aided by instruction that is based on assessment of the child's developmental level and by content that helps the child to focus on relevant aspects of such factors as conservation, seriation, and classification;
2) effective teaching requires repeated assessment of readiness;
3) children who have kindergarten experience score higher in later grades than those who do not have kindergarten experience;
4) ability to learn specific mathematical ideas is highly related to age and intelligence, and less strongly related to socioeconomic level; and
5) the use of manipulative materials aids primary grade children in developing mathematical ideas.

3/79:JV

Author:
Suydam, M.N., and Weaver, J.F.

Accession Number:
M A 0 1 5

Title:
Using research: A Key to elementary school mathematics (Rev.ed.). Columbus, Ohio: The Ohio State University, 1975 (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 238M).

Availability:
ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Rd - 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238M

Abstract:

This booklet consists of eleven bulletins designed to answer questions which teachers frequently ask about the learning and teaching of mathematics. (The bulletins are revisions of a set originally published in 1970). Each bulletin is organized around a central topic, and presents questions related to that topic, summaries of research findings relevant to each question, and a selected bibliography. Each bulletin is abstracted separately in this bibliography.

3/79:JV

Author:

Suydam, M.N. and Weaver, J.F.

Accession Number:

M A 0 1 5 J

Title:

Verbal problem solving. In Using research: A Key to elementary school mathematics (Rev. ed.) Columbus, Ohio: The Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No 238M).

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $3.00

Order No. 238M

Abstract:

This bulletin presents research findings regarding verbal problem solving in elementary school mathematics. The list of selected references includes 41 journal articles and dissertations. The most recent citation is dated 1975.

Research suggests:
1) IQ is significantly related to problem solving ability;
2) there are no sex differences in ability to solve verbal problems;
3) socioeconomic status alone is not a significant factor in verbal problem solving ability;
4) children seem to like a variety of problem settings, and this retains their interest;
5) formal analysis in problem solving has not been shown to be an effective procedure; and
6) evidence is not clear on whether it is helpful for pupils to work in pairs or small groups for verbal problem solving, rather than working individually.

The authors suggest that since almost all research on problem solving has been associated with whole numbers, a topic for future research should be the extent to which this research can be generalized to other kinds of numbers.

3/79:JV

Author:

Tanner, R. T.

Accession Number.

M A 0 1 2

Title:

Discovery as an object of research. School Science and Mathematics, 69: 647-655, 1969.

Availability:

School Science and Mathematics Ass'n. Inc.
Box 1614
Indiana University of Pennsylvania
Indiana, PA 15701

Abstract:

This articles presents a review of the experimental studies that have been conducted to determine the effectiveness of discovery learning as compared to expository learning in science and mathematics. Thirty-six references are cited; the most recent is dated 1968.

The author reports that these studies "defy synthesis" because of contradictory results, non-significant differences, and the variety of ways in which they were conceptualized. Suggestions for future research include:

1) analyzing existing studies more thoroughly;
2) providing more controlled experimentation;
3) investigating the effectiveness of different treatments for different learners; and
4) designing studies of longer duration.

Based on the ambiguity of the research results, the author advises those involved in curriculum and instruction to follow their own intuition and experience in making changes or innovations until further research evidence is available.

3/79:JV

Author:
Trimmer, R.G.

Accession Number:
M A 0 6 1

Title:
A review of the research relating problem solving and mathematics achievement to psychological variables and relating these variables to methods involving or compatible with self-correcting manipulative mathematics materials. Edwardsville, Illinois, Southern Illinois University, 1974 (ERIC Document Reproduction Service No. ED 092402)

Availability:
ERIC Document Reproduction Service
P.O. Box 190
Arlington, Virginia 22210

Cost: HC $2.06
MF $0.83

Order No. ED 092402

Abstract:
This literature review focuses on determining the psychological variables related to problem solving and presents arguments for self-correcting manipulatives as a media for teaching problem solving. Ten traits are considered: attitude, debilitating impulsive/ reflective thinking, concentration and interest span, motivation and interest, and perseverance and patience. Research in each of these areas as related to problem solving is cited. A list of 155 references is cited, including 27 dissertations. The most recent citation is dated 1973.

The author feels that the literature reviewed "indicates that manipulatives can provide a medium for fostering the growth of problem solving." He adds, "The question does not seem to be whether to use manipulatives or not but how and when to use them best."

Some specific findings are:
1) "intrinsic motivation and giving the student enough time to complete a task will facilitate the learning of problem solving";
2) "the impulsive state is probably useful in producing hypotheses";
3) "the reflective state is probably best for evaluating hypotheses"; and
4) "when the going gets tough it is concentration and persistence that pay off."

3/79·JV

Author:

Trueblood, C.K. and Jansson, L.C.

Accession Number:

MA017

Title:

Mathematics curriculum projects: Analysis and comparison. National Association of Secondary School Principals Bulletin, 58:88-96, 1974.

Availability:

National Association of Secondary School Principals
1904 Association Drive
Reston, VA 22091
(monthly September - May)

Abstract:

This paper presents a scheme for analyzing mathematical curriculum programs and projects being considered for adoption. The scheme or "anatomy" assumes that two kinds of information data are needed to describe the essential components of a mathematical program. One kind is factual data about the project such as origin, staff, and research. The other relates to what students will experience in the classroom in the way of content, instructional methodology, and implicit philosophy of education.

Each component of the anatomy is described in detail and procedures for using the anatomy are given.

2/79:JV

Author:
Van Engen, H.

Accession Number:
M A 002 A

Title:
Epistemology, research and instruction. In M. F. Rosskopf, L. P. Steffe & S. Taback (Eds.), Piagetian cognitive-development research and mathematical education. Reston, Va.: National Council of Teachers of Mathematics, 1971, 243 pp.

Availability:
National Council of Teachers of Mathematics
1906 Association Dr.
Reston, Virginia 22091

Cost: $6.75

Order No.: 73

Abstract:
In this document the author provides a number of operational definitions relational terms (e.g. longer than, as many as) and terms related to various aspects of number (e.g. ordinal, cardinal). Eight studies done between 1963 and 1968 at the University of Wisconsin) concerned with classroom applications of Piagetian theory are reviewed.

Among the research evidence cited:
1) the development of mathematical concepts arises out of experience with real objects;
2) the use of expressed transformations (e.g. four jacks in a pile and three more jacks put with them) facilitates mathematical learning.

3/79:JV

Author:
Walker, A.A.

Accession No.:
M A 0 5 9

Title:
The development of semantic components of number. Paper presented at the annual meeting of the American Education Research Association, Washington, D.C., March, 1975. (ERIC Document Reproduction Service No. ED 106147), 8 pp.

Availability:
ERIC Document Reproduction Service
P. O. Box 190
Arlington, Virginia 22210

Cost: HC $1.67
MF $0.83

Order No. ED 106147

Abstract:

In this paper the author reviews and synthesizes the research literature concerning the developmental relationships between conservation of number and linguistic capability in handling of quantitative and relational terms. Several modes for the development of these competencies are discussed. The list of references includes 11 journal articles and books including one dissertation. The most recent citation is dated 1974.

On the basis of this review the author concludes that linguistic mastery of relational concepts and comparison generally coincides with the appearance of conservation, and therefore, that "the development of comparative language is an essential component of the development of number concepts."

3/79:JV

Author:
Weaver, J.F. and Suydan, M.N.

Accession Number:
M A 0 2 1

Title:
Meaningful Instruction in Mathematics. Columbus, Ohio: ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, 1972. (ERIC Document Reproduction Service No. ED 068 329)

Availability:
ERIC/SMEAC Information Reference Center
Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost: $1.60 (Offset with cover)

Order No.: 210 M

Abstract:

This monograph focuses on the influence of meaning theory on elementary school mathematics programs and on mathematics instruction. The reference list provides 110 citations, the latest of which is dated 1971.

Theories of arithmetic instruction up through 1935 are described, and the philosophy of meaning theory, contributions and discussions by mathematics educators, and applications to instruction are delineated for the period from 1935 through 1960. A discussion of the implicit concern for meaning in the modern mathematics movement from 1960 to the present concludes the first section.

The second section summarizes studies that establish and affirm the importance of and need for meaning and studies that explore the effect of teaching various procedures with meaning. The final section of the paper briefly discusses the implementation of mathematically meaningful instruction. Evidence is presented that activities and experiences which contribute to students' understanding of mathematical concepts should precede work that focuses on drill, memorization of facts, or practice. Research on the advantages of using various approaches to provide meaningful instruction is inconclusive.

Author:

Wilkinson, J. D.

Accession Number:

M A 0 7 7 A

Title:

A review of research regarding mathematics laboratories. In W. M. Fitzgerald and J. L. Higgins (Eds.), Mathematics laboratories: Implementation, research, and evaluation. Columbus, Ohio: Ohio State University, 1974. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 231 M)

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

Cost: $2.10

Order No. 231 M

Abstract:

In this paper the author defines what he believes a mathematics laboratory to be; reviews the research dealing with math labs and activity learning and presents a summary of the trends indicated by research. The bibliography lists 48 references, including 31 dissertations. The most recent citations are dated 1971.

The author declines to draw any conclusions based on these research findings, because he feels that a great deal more research is necessary.

The author does list some trends that he has observed throughout the research on math labs and activity learning. Some of these trends are:
1) math labs seem to produce favorable achievement gains in primary age children but not in studies dealing with older children;
2) math labs seem to produce favorable achievement gains in the less able elementary child but not in groups of average or above-average ability;
3) math labs do not seem to have any differential effect on attitudes of elementary or junior high students;
4) demonstration treatments using activity oriented materials seem to be as effective as "hands-on" treatments; and
5) math labs show promise as a strategy to teach pre-service classes in mathematics methods.

Author:

Wittrock, M.C.

Accession Number:

M A 0 1 8

Title:

Recent research in cognition applied to mathematics learning. Papers presented at the meeting of the Special Interest Group for Research in Mathematics Education at the convention of the American Educational Research Association, New Orleans, 2/73.(ERIC Document Reproduction Service No. ED 077 773)

Availability:

Cost: $1.60

ERIC Information Analysis Center for Science, Mathematics and
Environmental Education, Ohio State University,
244 Arps Hall
Columbus, OH 43210

Order No.:218 M

Abstract:

This paper discusses recent research on cognition and its implications for mathematics learning. Thirty-six references are cited. The most recent citation is dated 1973.

Research support is presented for viewing learning as a generative process -- for learning to occur the learner must do something; organize something; make sense of something. Individual differences, hemispheric dominance the effects of motivation, and the effects of delaying reinforcement on retention are mentioned as influencing how learners structure, process and retain information.

Extrapolating from research findings, the author offers a number of implications for teaching mathematics:

1) use of only a few terms unfamiliar to students may have a disproportionate effect on mathematics learning;
2) structional organization familiar to students can be used to teach unfamiliar terms; and
3) brain research suggests that instruction should be introduced in a students preferred mode and then elaborated in his/her second mode.

The author believes that if a deeper understanding of mathematical learning is to emerge, the step-by-step mathematical and cognition process used by students to solve problems must be studied in detail.

Author:

Zepp, R.

Accession Number:

M A 0 7 8 B

Title:

Algorithms and mental computation. In M. N. Suydam and A. R. Osborne (Eds.) Algorithmic learning. Columbus, Ohio: Ohio State University, 1975. (ERIC Science, Mathematics and Environmental Education Clearinghouse No. 237M)

Availability:

ERIC/SMEAC Information Reference Center
The Ohio State University
1200 Chambers Road - 3rd Floor
Columbus, Ohio 43212

Cost $3.75

Order No. 237M

Abstract:

This paper discusses the importance of teaching mental computation and the possibility of teaching the algorithms involved in mental computation. Fourteen references are cited, the most recent one is dated 1972.

The author concludes that the literature is fairly consistent in stressing the value of teaching mental computation. He states, "Mental arithmetic can be effectively taught to both slow and fast learners. Moreover, instruction in mental computation has been shown to be of significant value in enhancing students' overall growth in arithmetic."

The author adds that research should be done to discover if there is a set of algorithms done to discover if there is a set of algorithms unique to mental computation and, if so, further research should be done as to the best method of teaching those algorithms.

3/75:JV

Author:

Zoll, E.J.

Accession Number:

M A 0 0 7 B

Title:

Research in Programmed instruction in mathematics. In R. B. Ashlock and W. L. Herman, Jr. (Eds.) Current research in elementary school mathematics. New York, Macmillan, 1970.

Availability:

The Macmillan Publishing Company
866 Third Avenue
New York, N.Y. 10022

Cost: $7.25 (paper)

Abstract:

This article reviews doctoral research in the use of programmed instruction in mathematics. Thirty-five studies are reviewed.

The author concludes that from the studies reviewed, it is not clear that individuals using programmed instruction learn at their own rate. However, in the dissertations reviewed very few commercially produced programs were used by the researchers, sample sizes were relatively small, the time spent in conducting the experiment was usually quite short, and the evaluative instruments often had to be constructed and validated by the investigator.

2/79:JV

Bibliography Index By Area

A	Attitudes and Affective Factors
B	Calculators
C	Concepts in Elementary School Mathematics
D	Creativity
E	Curriculum Research and Development
F	Developmental Factors and Cognitive Processes
G	Diagnosis and Remediation
H	Early Childhood
I	General Research Syntheses in Elementary School Mathematics
J	Instruction
K	Manipulatives and Activity-Based Learning
L	Miscellaneous
M	Organization for Instruction
N	Problem Solving
O	Reading and Mathematics
P	Sex Differences
Q	Socio-Economic Factors

A. Attitudes and Affective Factors

1.	Aiken, L.R., Jr.	"Research on Attitudes Toward Mathematics"
2.	Aiken, L.R., Jr.	"Update on Attitudes and Other Affective Variables in Learning Mathematics"
3.	Robinson, M.L.	*Attitudes and Achievement: A Complex Relationship*
4.	Suydam, M.N. and Weaver, J.F.	"Attitudes and Interests"

B. Calculators

1.	Bell, M., Esty, E., Payne, J.N., and Suydam, M.	"Hand-Held Calculators: Past Present and Future"
2.	National Council of Teachers of Mathematics	"Minicalculators"
3.	National Institute of Education, and National Science Foundation	*Report of the Conference on Needed Research and Development on Hand-held Calculators in School Mathematics*

C. Concepts in Elementary School Mathematics

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2.	Carpenter, T.P. and Osborne, A.R.	"Needed Research on Teaching and Learning Measure"
3.	Lesh, R.A. and Bradbard, D.A.	*Number and Measurements: Papers From a Research Workshop*
4.	Martin, J. Larry, Ed., Bradbard, David A., Technical Ed.	"Space and Geometry"
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6.	Payne, J.N.	"Review of Research on Fractions"
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8.	Suydam, M.N. and Weaver, J.F.	"Geometry and Other Methematical Topics"
9.	Suydam, M.N. and Weaver, J.F.	"Multiplication and Division with Whole Numbers"
10.	Suydam, M.N. and Weaver, J.F.	"Rational Numbers: Fractions and Decimals *In Using Research: A Key to Elementary School Mathematics"*

D. Creativity

1.	Aiken, L.R., Jr.	*Ability and Creativity in Mathematics*
2.	Balka, D.S.	"Creative Ability in Mathematics"
3.	Dunn, J.A.	"Tests of Creativity in Mathematics"
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E. Curriculum Research and Development

1.	American Institute for Research	*Metric Education*
2.	Begle, E.C.	"Curriculum Research in Mathematics"
3.	Lachat, Mary Ann, Capasso, Ronald Bartinique, Ingrid	*Math Programs That Work*
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6.	Trueblood, C.K. and Jansson, L.C.	"Mathematics Curriculum Projects: Analysis and Comparison"

F. Development Factors and Cognitive Processes

1.	Beilin, H.	"The Training and Acquisition of Logical Operations"

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3. Copeland, R.W.	How Children Learn Mathematics: Teaching Implications of Piaget's Research
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6. Lovell, K.	"Intellectual Growth and Understanding Mathematics"
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G. Diagnosis and Remediation

1. Brant, V., and Cox, G., DeVenney, W.S., Hoffman, R.I., Johntz, W.F., Mendelsohn, M., Scott, J.L., Sharron, S., and Strobel, L.R.	"Promising Programs and Practices"
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5. National Council of Teachers of Mathematics	The Slow Learner
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H. Early Childhood

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J. Instruction

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5. Suydam, M.N. and Dessart, D.J.	"Classroom Ideas From Research on Computational Skills"
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K. Manipulatives and Activity-Based Learning

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N. Problem Solving

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O. Reading and Mathematics

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